

November 3, 1997
Project No. 97094.00

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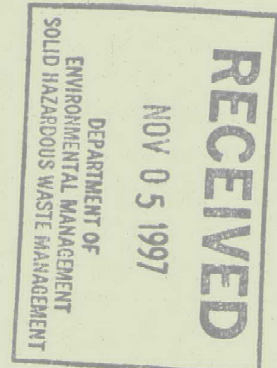
Groundwater Sampling and Analysis Plan Feddeler Construction/Demolition Site Lake County, Indiana

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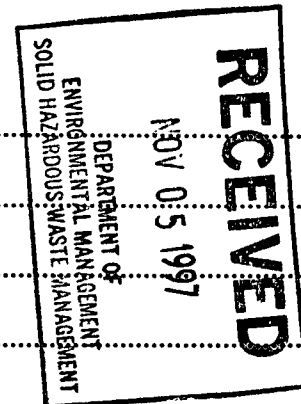
INVOICE DATE	INVOICE NO.	GROSS AMOUNT	% DISC.	DISC. AMOUNT	NET AMOUNT	REMARKS
7/26/96	DEM	100.00		.00	100.00	<p>RECEIVED</p> <p>AUG 1 2-1996</p> <p>CASHIER/PAYROLL</p>
BLOCKSOM & CO. MICHIGAN CITY, IN. 46360					100.00	

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**GROUNDWATER SAMPLING AND ANALYSIS PLAN
FEDDELER CONSTRUCTION/DEMOLITION SITE**

TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
2.0 PURPOSE.....	1
3.0 SAMPLING DATES.....	2
4.0 ANALYTICAL PARAMETERS.....	2
5.0 GROUNDWATER MONITORING SYSTEM.....	2
6.0 PRE-SAMPLING ACTIVITIES.....	2
7.0 SAMPLER TRAINING.....	3
8.0 ACCESS RESTRICTION AND WELL SECURITY.....	4
9.0 REVIEW OF SAMPLING AND ANALYSIS PLAN.....	4
10.0 SELECTION OF EQUIPMENT.....	5
11.0 PURGING EQUIPMENT.....	5
11.1 Bailer.....	5
12.0 FIELD METERS FOR pH AND SPECIFIC CONDUCTANCE.....	6
13.0 TEMPERATURE AND PHYSICAL APPEARANCE.....	6
14.0 FIELD PERSONNEL SAFETY EQUIPMENT.....	6
15.0 EXTERNAL CONTAMINATION PREVENTION EQUIPMENT.....	6
16.0 CORD/ROPE.....	7
17.0 FIELD FILTRATION.....	7
18.0 DECONTAMINATION OF NON-DEDICATED EQUIPMENT.....	7
18.1 Bailers.....	7



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**GROUNDWATER SAMPLING AND ANALYSIS PLAN
FEDDELER CONSTRUCTION/DEMOLITION SITE**

TABLE OF CONTENTS

18.2 Field Reading Meters.....	8
18.3 Teflon Coated Wire	8
18.4 Field Filtration Systems.....	8
18.5 Water Level Indicators.....	8
19.0 PIEZOMETRIC/POTENTIOMETRIC SURFACE READINGS.....	9
20.0 TOTAL WELL DEPTH.....	9
21.0 WELL EVACUATION	9
21.1 Methods of Evacuation	9
21.2 Evacuation: Rate and Volume	9
22.0 SAMPLE COLLECTION TECHNIQUE	10
22.1 Bailers.....	10
22.2 Order of Sample Collection	11
22.2.1 Low Water Sampling Contingency	12
23.0 CONTAINERS, CONTAINERIZING OF SAMPLES, AND MINIMUM SAMPLE VOLUME.....	12
24.0 PRESERVATIVE AND FILTRATION METHODS.....	13
25.0 QUALITY CONTROL BLANKS	13
25.1 Trip Blanks	13
25.2 Equipment Blanks.....	13
25.3 Field Blanks.....	14
26.0 QUALITY CONTROL SAMPLES.....	14
26.1 Duplicate Samples	14
27.0 ANALYTICAL METHODS	15

**GROUNDWATER SAMPLING AND ANALYSIS PLAN
FEDDELER CONSTRUCTION/DEMOLITION SITE**

TABLE OF CONTENTS

28.0 CHAIN OF CUSTODY PROCEDURES.....	15
29.0 DEFINITIONS SECTION	16

LIST OF TABLES

Table 1 - Summary of Monitoring Well Network

Table 2 - Sampling Containers and Preservatives

LIST OF FIGURES

Figure 1 - Site Location Map

Figure 2 - Monitoring Well Location Map

LIST OF APPENDICES

Appendix A - Owners/Operators Manuals for Sampling Equipment

Appendix B - Quality Assurance Project Plan

Appendix C - Chain of Custody Record

Appendix D - Field Sampling Form

1.0 INTRODUCTION

The following presents a Sampling and Analysis Plan (SAP) for implementation of groundwater monitoring activities at the Feddeler Construction/Demolition Site, operated by R&M Enterprises, Inc. The Feddeler Construction/Demolition Site is a construction demolition waste landfill, located just west of Lowell, in West Creek Township, Lake County, Indiana (see **Figure 1 - Site Location Map**).

In compliance with Solid Waste Facility Permit FP# 45-08, R & M Enterprises, Inc. operates and maintains a groundwater monitoring system capable of detecting statistically significant changes in groundwater quality occurring downgradient of the facility.

Pursuant to permit condition D10, all groundwater monitoring wells which constitute the facility's permanent groundwater monitoring well system shall have water quality samples taken and tested individually on a semiannual basis during the months of June and December.

2.0 PURPOSE

This Sampling and Analysis Plan (SAP) for the Feddeler Construction/Demolition Site has been developed in accordance with 329 IAC 10-21-2. In addition, permit condition D9 indicates that a SAP shall be submitted for approval, in writing from the OSHWM staff. The purpose of the SAP is to provide a framework for the consistent collection of groundwater samples, which are verifiable and representative of the site's groundwater conditions. Adherence to a standardized protocol for sample collection, management and analysis procedures will allow collected data to be comparable over time.

Specific procedures for groundwater sample collection, water level measurement, sample preservation and handling, chain of custody procedures, and analysis of samples collected at the Feddeler site are described in the following sections. All sampling and analysis of groundwater at the Feddeler site will be performed in strict accordance with the procedures and methods outlined in this plan. All personnel involved in groundwater sampling at the Feddeler site must review and become familiar with the requirements of this SAP. Any deviation from this plan requires prior approval from IDEM. In addition, any revision of this plan will be forwarded to IDEM prior to implementation in the field.

3.0 SAMPLING DATES

Solid waste facility permit FP# 45-08 regulates the Feddeler Facility. The Feddeler Construction/Demolition Site is currently required, in accordance with the above referenced permit, to perform groundwater sampling on a semi-annual basis. Groundwater sampling events are required to occur in the months of June and December.

4.0 ANALYTICAL PARAMETERS

According to permit condition D10, the detection groundwater monitoring parameters (i.e. Phase I parameters) for the site consist of the following:

- Field pH
- Specific conductance
- Chloride
- Barium
- Arsenic
- Sodium
- Sulfate
- Ammonium
- Methylene chloride
- 1,1-Dichloroethane
- Toluene
- Benzene
- 1,2-Dichloroethylene (total)
- Ethyl benzene
- 2-Butanone (Methyl ethyl ketone)
- Total phenolics

5.0 GROUNDWATER MONITORING SYSTEM

Table 1 presents specific Feddeler Construction/Demolition Site monitoring well network detail. Groundwater monitoring well locations are illustrated on Figure 2.

6.0 PRE-SAMPLING ACTIVITIES

Preparation for a successful sampling event must begin in advance of field sampling operations. In as much as possible, sampling events will be scheduled at least two weeks in advance of the sampling event. This will allow time for the preparation and assembly of sampling equipment, sampling bottles, labels, chain of custody forms, and field data sheets.

It is important to note that, although every effort will be made to adhere to established monitoring schedules, sampling events may be subject to change based on factors such as weather. No sampling will occur at the Feddeler Construction/Demolition Site during inclement weather conditions, including:

- when precipitation in the form of rain or snow will potentially contaminate samples.

- when winds are strong enough to cause blowing dust and other materials to uncontrollably contaminate samples.
- when the weather is so cold that it interferes with the operation of equipment or the sampling crew's ability to exercise effective quality control.

The decision to postpone or delay a sampling event will be at the discretion of the project manager and will be reported to the IDEM if such a delay extends beyond the calendar month for which the sampling event was originally scheduled.

Prior to each sampling event, analytical results from the previous sampling event will be reviewed. Under the direction of the project manager, a well sampling sequence will be developed for the upcoming sampling event. The upgradient wells and downgradient wells are designated for the purpose of well sampling order. Wells will be sampled in order of increasing potential for impact from the facility (see Section 22.2). The sampling team will determine the sampling order prior to arriving at the facility. The following presents a brief summary of the facility monitoring well network:

Upgradient Wells

MW-1
MW-3
MW-5
MW-8

Downgradient Wells

MW-2
MW-4
MW-6
MW-7
MW-9
MW-10
MW-11

7.0 SAMPLER TRAINING

Field sampling personnel are key to ensuring the overall quality control of the data. All sampling personnel should receive formal training in proper sample collection techniques. Key responsibilities and tasks which must be completed by field personnel include:

- Reviewing the sampling and analysis plan. Field sampling personnel should develop an understanding of sampling locations, methods, sample quantities, and personal protective measures required on-site;

- Ensuring that a copy of the sampling and analysis plan is available for reference at the monitoring well head each time groundwater samples are collected;
- Ensuring that samples are representative of the conditions and the matrix from which the sample was collected by following the procedures outlined in the sampling and analysis plan;
- Ensuring that only equipment specified in the sampling and analysis plan are used to collect groundwater samples;
- Calibrate field meters at the beginning and the end of the day to verify proper operation. Document the calibration with the field meter identification, date and time of calibration, calibration standards used, calibration results, and the name of the person who performed the calibration in the field log book (calibration procedures are included in **Appendix A**);
- Properly preserving, packaging, and shipping samples to ensure that they arrive at the laboratory unchanged;
- Implementation of chain-of-custody procedures and the proper documentation of field conditions and field measurements such as pH, temperature, and specific conductance.

8.0 ACCESS RESTRICTION AND WELL SECURITY

Access restriction is provided for the site by chain link fencing. No persons will be allowed into the facility without the facility operator's consent, or legal search authority under statute or rule. All wells are provided with a security system, including a damage preventive casing and access restriction.

The primary method of damage prevention is a metal outer casing around the well riser. Additional damage prevention, and increased visibility, is provided for all wells in close proximity to roadways by guard posts surrounding the well. Each well is provided with a lock that will prevent unauthorized access to the well riser. Lock mechanisms are serviced at least twice a year (when the well is sampled) to check operation.

9.0 REVIEW OF SAMPLING AND ANALYSIS PLAN

Prior to the sampling event, field personnel will review the Sampling and Analysis Plan to become familiar with the sampling procedures, objectives, and expected site conditions. Field personnel must also perform any necessary equipment inventories and inspections, and coordinate with the laboratory so that the required sample kits (containers) are available.

The majority of these tasks may be completed several days prior to sampling, however any equipment that is maintained at the facility will be inspected on the day of sampling.

10.0 SELECTION OF EQUIPMENT

Equipment utilized during a sampling event may vary due to the multiple activities and readings required by IDEM regulations and site specific conditions. Each set of equipment is selected based on consideration of the conditions unique to the Feddeler Construction/Demolition Site. Controlling factors in the selection of equipment include:

1. The parameters possible for detection at the site.
2. The accuracy of the readings produced by the equipment.
3. The ease of operation (including calibrations).
4. Serviceability.
5. Portability.
6. Ruggedness.

11.0 PURGING EQUIPMENT

11.1 Bailer

The primary method for well evacuation will be by dedicated PVC bailer. A bailer is a bottom filling tube designed to penetrate the water column and fill, and reseal by the use of a check valve/stopper device (usually a check ball). The technology of the bailer represents the most basic design, rendering the bailer the most resistant to mechanical failure. Bailers are suited to withdrawal of sample waters with minimum agitation. Withdrawal rate with a bailer is strictly controlled by the sampler. The rate of purging using a bailer is rarely great enough to cause cascading of the formation water into the well. Furthermore, the amount of suspended sediment does not adversely effect the performance of a bailer in removing water from the well.

The bailers utilized at the Feddeler Construction/Demolition Site will be dedicated, meaning they will be used exclusively in a single groundwater monitoring well. The bailers will remain suspended in the monitoring well, above the water column when not in use.

12.0 FIELD METERS FOR pH AND SPECIFIC CONDUCTANCE

All field equipment used during sampling events will be calibrated before each sampling day according to the manufacturer's specifications. The source and type of calibration standard used will be stated on the field record, and the solution retained for use at the end of the sampling day. Field meter calibration standards will be dictated by the historical data from the site. Standards will be more acid than the most acid wells average reading, and a second standard will be more base than the most alkaline wells average reading. A copy of the owner/operators manual for each field instrument anticipated to be utilized for sampling activities at the Feddeler Construction/Demolition Site has been provided as **Appendix A**.

13.0 TEMPERATURE AND PHYSICAL APPEARANCE

Equipment will be utilized to record the in-situ temperature of the groundwater in degrees Celsius on the field record. This reading is to allow correction of calculations involving groundwater if the calculations are temperature sensitive. Physical appearance of the groundwater, measured by visual observation of the sampling team, will be recorded in the field record (see **Appendix D** for an example of the groundwater sampling field form).

14.0 FIELD PERSONNEL SAFETY EQUIPMENT

Field sampling personnel will don protective clothing appropriate to any suspected hazardous conditions that may be encountered based on previous results of samples collected at the site. Applicable regulatory provisions of the Occupational Safety and Health Administration (OSHA) will be adhered to by field personnel. Latex or vinyl gloves will be worn by the sampling crew anytime personal contact is possible with sample water, open sample containers, sampling equipment (previous to, during or after introduction of the equipment into the well), or the open well.

15.0 EXTERNAL CONTAMINATION PREVENTION EQUIPMENT

Under no circumstance will any equipment to be introduced into the well be allowed to come into contact with the ground. This is to prevent introduction of potentially contaminated soils into the well. A plastic sheet will be placed in the area around the well protective casing to prevent contact between equipment and the soil. Additional protection from cross-contamination concerns may be provided for bailer cord by supplying a plastic lined container to temporarily hold excess cord as it is withdrawn. All equipment to be utilized for samples from more than one

sampling point will be decontaminated. Decontamination procedures for non-dedicated equipment is described below in Section 18.0.

16.0 CORD/ROPE

Bailers require the use of cord to lower the equipment into the water column. In the event bailers are used for the sampling event, the cord's chemical composition must be recorded on the field record. If necessary, dedicated 3/8" polypropylene rope with 3' long x 3/32" diameter Teflon coated stainless steel wire leader will be used in conducting purging and sampling activities at the Feddeler Construction/Demolition Site. When not in use, dedicated rope will be stored in a labeled, sealable plastic bag. Reuse of flexible rope of any composition in multiple wells is forbidden. The length of cord in contact with the water at anytime should be minimized.

17.0 FIELD FILTRATION

The sampling crew will filter dissolved metal analysis samples in the field. In-line high capacity disposable filter cartridges with a maximum pore size of 0.45 microns will be utilized. The QuickfilterTM model # FF8200 in-line disposable filter, manufactured by QED Groundwater Specialists, located in Ann Arbor, Michigan will be used to field filter all dissolved metals samples. Alternative filters may be used if equivalent to the above.

18.0 DECONTAMINATION OF NON-DEDICATED EQUIPMENT

Decontamination of non-dedicated equipment applies to any equipment employed in acquisition of independent grab samples from more than a single well. Techniques for decontamination are specific to the equipment being cleaned. All equipment that has been decontaminated for reuse will be rinsed by water withdrawn from the sampling source (where possible) prior to introduction to the sample.

18.1 Bailers

In the event that non-dedicated bailers are used to sample any of the existing facility wells, they will be decontaminated after each use. This will be accomplished by washing the entire assembly (valve and tube) in a non -phosphate detergent and potable water bath, utilizing a bailer brush of the appropriate size for abrading the interior of the bailer. The bailer and valve will then undergo a gross rinse in potable water. The bailer will then be double rinsed in deionized or higher grade water. When not in use, the bailer will be stored in a predesignated container.

18.2 Field Reading Meters

Meters for specific conductance, temperature, and pH will be washed with a non-phosphate detergent solution and rinsed with a volume of deionized water equal to a minimum of four times the volume used by the meter for effective reading.

18.3 Teflon Coated Wire

The entire length of wire will be submersed in a non-phosphate detergent bath. The full length must be abraded by a clean cloth as it is removed from the wash bath, and deposited into a gross rinse bath, composed of potable water. The cord will then be lifted as a coil and placed in a final deionized water rinse.

18.4 Field Filtration Systems

Reuse of filter membranes for more than one sample is prohibited. Equipment for conveying the sample through the membrane can be used for multiple samples, provided that it is properly decontaminated between samples. The first concern is the decontamination of the intermediate container between extraction from the well, and contact with the dedicated filter membrane. The containment reservoir and all parts contacted by the sample water will be washed by a non-phosphate detergent bath, abraded with a clean brush or cloth in the bath, gross rinsed in at least potable water, and finally rinsed in deionized water. Prior to filtration of the next sample, the reservoir will be rinsed by the water of the next well to be sampled before filling the reservoir to filter the next sample set.

18.5 Water Level Indicators

Water level indicators will be decontaminated before being introduced into any well. The head of the indicator will be cleaned in a non-phosphate detergent wash after each well. The probe will be abraded with a bristled brush in the detergent in order to remove any contaminants. The probe will then be double rinsed in deionized water. The measuring tape for the water level probe will be decontaminated in the same manner as Teflon coated wire in this section. The tape will be decontaminated at a length equal to the total depth of the well plus the well riser height, plus three (3) feet. Non-Phosphate detergent baths utilized in the decontamination of field equipment will be mixed following the manufacturers label instructions. The amounts of detergent and water used in the mixture will be recorded on the facility field sheet, along with the brand name of the detergent used.

19.0 PIEZOMETRIC/POTENTIOMETRIC SURFACE READINGS

During each sampling event, the sampling team will obtain a static water level reading at each well or piezometer listed in **Table 1**. Prior to the removal of any water from a monitoring device, the water level will be acquired by measuring the water level in relation to the survey mark on the well riser. The method to be used requires that static water level in a well be measured just prior to purging. Water level measuring devices will be accurate to 0.01 feet.

20.0 TOTAL WELL DEPTH

Total well depth will be measured at the same time as the static water level to assess the effectiveness and state of repair of the well. If the total depth of the well is significantly different from the well depth recorded on the well driller's record, the sampling team will note these findings on the field record. Upon evaluation, required repairs will be made to affected monitoring wells, or a demonstration will be made that the well's performance is unaffected by the well depth change, and that the same hydrostratigraphic unit is being monitored by the existing screened interval of the well.

21.0 WELL EVACUATION

21.1 Methods of Evacuation

To ensure the collection of a representative sample of water in the formation, the static water in the well casing must be removed. The method of evacuation will be suited to the recharge rate of the specific well, the well depth, and the diameter. Suitable equipment will in all cases, fit within the well riser without inflicting damage, be easily retrieved up the riser, and remove volumes of water in a time efficient manner. The primary method for well evacuation and sampling will be by dedicated PVC bailer.

21.2 Evacuation: Rate and Volume

The withdrawal rate will not create a great inward gradient, or cause the water to enter the well at a highly accelerated rate. Evacuation of the well at a rate causing the water to cascade over the well screen on entering the well is prohibited. Complete removal of stagnant water (purging dry) is the only certain way to assure the evacuation of all stagnant water in the well casing. In some cases, recharge rate is too great to allow purging a well dry.

The volume of water to be removed, by bailing, for effective purging is the amount necessary in order to achieve stability, as defined below. Purging extremely large volumes of water is prohibited since the object is to sample formation water in the vicinity of the well. Purging large volumes of water does not accomplish removal of stagnant waters, but can potentially draw water from greater distances to the well. The water drawn to the well could potentially dilute any contaminants in the vicinity of the monitoring well.

To assure that purging has been effective in drawing fresh formation water into the well, purging should be continued until the field parameters of pH, Specific Conductance and Temperature have stabilized within $\pm 10\%$ of a field determined mean value. The minimum number of samples required in order to make this determination shall be four. A minimum of four sets of field measurements will be taken (approximately every three to five minutes) during the purging process. The first three will be used to calculate a field mean and the fourth will be compared to this value.

If the sample is not within $\pm 10\%$ of the field determined mean after four sets of readings have been taken, then another set of readings will be taken after another three to five minutes. This reading will be compared to the mean of the previous readings. If this value is not within 10% of the mean, then purging will continue for approximately another three to five minutes. A sixth and final set of measurements will then be taken. If the above objective still has not been attained, then this will be noted on the field data sheets and sampling will begin because the objective is to sample groundwater in the vicinity of the well, and purging larger volumes of water could potentially draw water from greater distances to the well.

22.0 SAMPLE COLLECTION TECHNIQUE

Samples will be collected in such a manner as to minimize the likelihood of volatilization or external contamination. The exact collection method depends on the equipment to be utilized during sampling.

22.1 Bailers

Sampling from a bailer will be conducted in a manner which minimizes the contact of the water with potential external sources of contamination. Protective hand gear (latex gloves) will be used to prevent direct contact of the sampler's hands and the bailer. The bailer will be lowered in a slow and steady manner until the top of the groundwater is contacted. The bailer will then be

lowered carefully into the water column until the bailer is full, or the base of the well is contacted by the bottom of the bailer. Once filled, the bailer will be lowered no further into the water column. Care should be taken not to contact line lengths of the bailer cord into the water column. Contact minimization between cord and sample water reduces potential contamination introduced from the cord, and assures the uppermost zone is being monitored. The bailer will then be withdrawn at a slow steady rate up the well casing. When the bailer reaches the top of the well riser, it will be removed carefully to prevent aeration or agitation. The bailer cord should be pulled away from the water flowing from the top of a top discharging bailer. Where organic constituents are suspected, bottom discharging bailers can be utilized for appropriate samples in the set.

22.2 Order of Sample Collection

Wells will be sampled in order of increasing potential for impact from the facility. All upgradient wells will be sampled before any downgradient wells are sampled. The order in which downgradient wells are sampled will be determined using previously acquired sample data to assess potential impacts. Impacted wells will be sampled in order of increasing degree of affectedness. If no well is confirmed or suspected of being impacted, the most distant downgradient wells from the nearest waste will be sampled first. Wells will be sampled in order of decreasing distance from in place waste. Where wells are approximately equal in distance from waste, wells closer to the most recently placed waste will be sampled before wells close to waste in place for longer periods of time. The sampling team will determine the sampling order prior to arriving at the facility. The well sampling order will accompany the analytical results.

The order of sample collection will be established to account for the parameters to be analyzed. The normal order of sample collection will reflect volatility of the compounds to be analyzed and enforcement potential of the parameter (established MCL under the Clean Water Acts). Under adequate water supply conditions, the normal collection order for wells in routine Phase I monitoring will be:

1. VOC's,
2. field parameters (pH and specific conductance),
3. dissolved metals,
4. parameters extracted from unpreserved sample.

22.2.1 Low Water Sampling Contingency

In the event of dramatic seasonal fluctuations in the water table, the Feddeler Construction/Demolition Site has developed a contingency sampling order for a low water supply. Based on previous analytical data, the following sampling order for a low water supply has been established.

1. dissolved metals,
2. field parameters (pH and specific conductance),
3. VOC's,
4. parameters extracted from unpreserved sample.

23.0 CONTAINERS, CONTAINERIZING OF SAMPLES, AND MINIMUM SAMPLE VOLUME

Varying parameter and method types dictate specific chemical materials for sample containers to minimize contamination by the container. Sample containers will be new, and accompanied by the manufacturer's certificate of analysis for the container lot number. Provided as **Table 2** are the requirements for preservatives, bottle material composition, and refrigeration. Samples collected for volatile organic constituents will have zero head space. Samples will be poured into the container so that water entering the bottle contacts the wall of the bottle and runs down the wall to the sample already containerized. The side wall method should be used continuously for 40 ml vials. Liter bottles should be sidewall filled where the neck of the bottle allows tipping of the container.

To ensure a successful sampling event, double the minimum volume required for analysis should be collected at each well (to allow for laboratory error), when well water production permits. Sampling equipment contact with containers will be minimized to prevent cross contamination. Containers will be kept in a secure area (away from possible sources of contamination) prior to use. Chemicals used as preservatives will be referred to by source and concentration. The source laboratory or manufacturer of the chemicals used as preservatives will provide, upon request, an analysis of the trace elements present in the preservatives, the concentration of these impurities, and the methods used in the preparation of the chemicals. The required information on preservation source and batch number will appear on the field documentation for each sample set collected. Waters used must be of deionized grade or better. Any water used for

decontamination purposes will be collected in an equipment blank and analyzed (see Section 25.2).

24.0 PRESERVATIVE AND FILTRATION METHODS

Chemical preservatives will be added to sample bottles prior to filling of the bottle. Physical preservation of the sample set will include prevention of exposure to direct radiation (solar or other) and expedient refrigeration of the sample to a temperature of near 4°C. Refrigeration temperature will be confirmed by the use of a thermometer in each cooler containing samples. The temperature in the cooler upon arrival at the analytical laboratory should be recorded on the field record and on the chain of custody.

Dissolved metals samples filtered by non in-line equipment will be initially collected in a non-preserved container (bottle, reservoir or other decontaminated container) prior to filtering. The dissolved metals sample will be propelled through the filtration device and the sample will be placed into the preserved bottle as the sample exits the filter membrane.

25.0 QUALITY CONTROL BLANKS

The following quality control blanks will be obtained during each routine semiannual groundwater monitoring event at the Feddeler Site:

25.1 Trip Blanks

Trip blanks will be taken by the sampler prior to the collection of any monitoring well sample. The trip blank will be deemed a sample and will accompany the other samples from the site at all times. This ensures that the trip blank is exposed to all conditions to which the samples are exposed. The facility may collect and analyze as many trip blanks as desired, but a minimum of one trip blank is required for each sampling event. If the trip blank is containerized prior to entry onto the site, the blank is not deemed to be a sample until such time as the trip blank sample physically enters the facility monitoring/compliance boundary.

25.2 Equipment Blanks

At least one equipment blank will be collected from each piece of non-dedicated equipment used to collect samples at the site. This includes non-dedicated pumps, intermediate containers, and reusable sections of the filtration equipment. The blank may be limited to the parameters

potentially effected by the multi-use equipment. This blank can also be used as a check on sample collection and decontamination procedures.

25.3 Field Blanks

At the end of each sampling day the field sampler will collect one field blank sample. Field blanks will be a complete set of samples, consisting of deionized or distilled water, containerized at the head of any monitoring well during the sampling event. The sampling crew (at their option) may collect multiple field blanks during a single sampling event, if the samplers feel that conditions at the well riser may contaminate the sample from a source other than the groundwater. A field blank's main purpose is to ascertain any ambient site conditions (exhaust, dust, cross-contamination) effects on the samples collected.

The water used for the field blank sample must be distilled water or deionized water brought onto the site and poured into the designated sample bottles within fifty (50) feet from any groundwater monitoring well sampled the day the field blank is collected.

26.0 QUALITY CONTROL SAMPLES

26.1 Duplicate Samples

Duplicate samples should be collected in a concurrent manner. Duplicate samples are collected by filling all bottles of each analysis, then proceed to the next analyte. Each sample set will be numbered and labeled in a unique manner. Well information will be recorded. The well will be purged in the approved manner and to the required volume. Collection will occur in the approved order for parameters. All VOC containers from all sample sets will be filled (if VOC are being sampled), then the field parameters (pH and specific conductance, etc.) will be repeated twice until all parameters are sampled for analysis. Sufficient volume of water must be present in the well to collect the duplicate sample in a single purge and sample event of the well for all required parameters. Procedurally, duplicate samples are not independent of each other. All samples are split from the same aliquot of water for individual analysis.

For each groundwater sampling event, a duplicate sample will be collected if more than one well is purged and sampled. Duplicate samples will be collected at a frequency of one duplicate per groundwater sampling event.

27.0 ANALYTICAL METHODS

To assure the validity of data acquired from groundwater samples, the Feddeler Construction/Demolition Site has included as **Appendix B** a Quality Assurance Project Plan (QAPP) for the facility's contracted analytical laboratory, SIMALABS International Laboratories, Inc. located in Merrillville, Indiana.

28.0 CHAIN OF CUSTODY PROCEDURES

The Feddeler Construction/Demolition Site will, when conducting sampling events, utilize a chain of custody protocol. The purpose of chain of custody is to legally account for the possession and security of the samples from the time the samples are extracted, until the printing of the analytical results.

The chain of custody is to be divided into two parts (see **Appendix C**). The field chain of custody will account for the sample(s) from the time the sample is removed from the well and placed into the appropriate container, until the sample custodian of the analytical laboratory signs the field chain of custody, taking possession of the sample. The laboratory chain of custody will account for the location and security of the sample from the sample's arrival at the analytical laboratory until analysis of the sample is found to be acceptable under the facility QAPP.

The chain of custody is a legal documentation of persons having contact with the sample from the time of collection, until conclusion of analysis. Anyone signing the chain of custody may be called as a witness in legal actions to testify to the whereabouts and security of the sample(s) while in the possession of the signatory. Each sample set will be recorded by a unique identifier on the chain of custody record, including:

- number of containers in the sample set
- all persons in contact with the sample(s), (sampler/sampler(s), transport personnel, analysts)
- times and dates of surrender of sample(s) to another party
- the analysis to be performed on the sample(s).

The field chain of custody will be submitted as part of the analytical results for the monitoring program. The laboratory will maintain the laboratory chain of custody to be released to the Indiana Department of Environmental Management upon request.

29.0 DEFINITIONS SECTION

Access Restriction - A physical and psychological barrier which limits the free entry of a person into an area or object. This can include but is not limited to signs, fences, locks and security patrols/stations.

Complete Data Packages - Will include at a minimum: Field documents, calibration logs for all field meters, analytical results for samples collected, initial calibration curves for wet chemistry analyses, metals, and organics, chain of custody records (copies will suffice), documentation as required in the QAPP, and all information required in the operating or closure permit.

Composite Sample - Samples representing a series of sampling points or chemical compositions. Composite sampling is not allowable for groundwater monitoring for the purposes of detection or assessment monitoring. Corrective action plans may include composite sampling as a part of proposed mixing model or remediation plan.

Dedicated Equipment - Sampling or bailing apparatus which is used exclusively for use in a single groundwater monitoring well. This can include parts of an apparatus which is the only part which will come in contact with the material to be analyzed. Filter membranes, bailers, rotary pump systems and sample containers are examples of dedicated equipment.

Dry Well - Any groundwater monitoring device which is unable to:

1. Deliver water to be purged from the well casing when opened for sampling, but is mechanically undamaged.
2. Does not have a recovery rate great enough to supply groundwater for sampling utilizing the facilities low water order as defined in the SAP plan within a 24 hour period after the well is purged.

Wells which are dry on a consistent basis will be deemed malfunctioning under the well maintenance section and must be replaced or delisted to piezometers and relocated. Solid waste facilities geology section may grant variance to this definition, case by case.

Duplicate Sample - A sample collected to provide evidence that the conditions are repeatable but does not assume that conditions at the well do not change over short periods of time. Procedurally, duplicate samples are not independent of each other. Duplicates are collected by

filling all bottles of each analysis, then proceed to the next analyte. All samples are split from the same aliquot of water for individual analysis.

Evacuation - Removal of water from a well or piezometer for the reason of preparing the well for sample collection, by purging stagnant water from the screened interval, or the act of collecting a representative groundwater sample, duplicate, or field confirmation sample from a groundwater monitoring well.

Field Documentation - Records of the physical conditions of the collected samples. These readings include water temperature, water color, specific conductance of sample, solution pH, time of collection, on site weather conditions and other parameters as required in the site SAP. The samplers opinion or perceptions are to be recorded here. Conditions as ambient odors/vapors, reactions with preservatives, difficulty capping without head space, et al are vitally important and should be reported on the field record. All observations recorded in the field document will be legally binding and admissible as evidence (written observations of an eye witness) in a court of law. Field documents will be signed by all field staff present at the time of the sample collection/observation (also equivalent to field log, field book, field record and field sheet et al).

Field Sampling Event - That period of time commencing with initial entry of the sampling team, until such a time as the entire sampling of all scheduled devices locations/measurements are complete or deemed as inaccessible. This time will include all related activities (calibrations etc.) whether accomplished on or off site. The field sampling event will be deemed as ended when transport of the samples are complete and the chain of custody proceedings are signed by the sample officer at the analytical laboratory.

Gas Lift Pumps and Gas Drive Pumps - Pumps of these descriptions are not acceptable for use in sampling of monitoring wells in the state of Indiana.

Grab Sample - A sample acquired "mid flow" or in a manner to collect the media to show a single point in space and time set of conditions.

Independent Sample - A sample or sample set collected in a manner which provides a unique measure of the chemical and physical properties of the water passing within the area affected by the well screen's interval over the period of time elapsed during sample collection.

Indicator Media - Such substances that can indicate the types or specific chemical constituents or physical conditions (i.e. temperature) likely to be produced or actually produced by influence of a solid waste disposal facility. These media can be liquid/aqueous, or solid. The most outstanding examples are water (both surface and ground) monitoring, waste stream testing and soil monitoring.

Metal Protective Casing - Any malleable substance meeting the description of Metal or Semi-metal under ASTM standards (most notably Aluminum or Steel of any alloy) which is formed into a shape to completely surround the well riser. The metal casing will be configured to accommodate the application of a locking mechanism to the casing. When open, the protective casing will provide clear access to the well riser, well cap and any well purging equipment in the well. The metal protective casing will be secured to the ground by either attachment to the grout materials (existing wells) or bolting the casing into the concrete pad provided the well (new wells).

pH - (-log [H]), Dissolved hydrogen ion activity concentration.

Recharge Rate - The time per unit volume required for a groundwater monitoring well to draw water from the formation around the screened interval of the well (this rate may equal or exceed the withdraw rate). In such a case, a well is instantaneously recharging. In cases where withdrawal of volume per unit time exceeds the transmissivity of the aquifer a cone of depression is formed. This cone's shape is a direct result of the recharge rate of the well and the transmissivity of the aquifer.

Representative Sample - Sample which accurately portrays the conditions present at a location. The location could be on any scale, at any time or could be very specific and local. The result of analysis should be reproducible by duplicate sample with only minor variation. Representative samples are not average or composite values unless specified as such.

Rotary Pump(s) - Any pump which utilizes an impeller, piston or other mechanical parts in the path of water flow. The main physical force used to propel the water is pressure gradient/vacuum. The action of the moving parts can tend to agitate water passing through the pump. This includes Helical Rotor Pumps, Piston Type Pumps, Gear Drive Pumps and Centrifugal Pumps.

Sample - A set of containers which has been prepared to transport a volume of indicator media to an analytical laboratory for analysis in a manner consistent with the facilities Quality Assurance Project Plan. The sample will include as many individual containers as are necessary to comply with the required sampling event requirements. The containers will be prepared in a manner consistent with the facilities QAPP in regards to preservatives, composition, physical conditions, et cetera. Each sampling point will produce one independent sample, and possibly replicates, duplicates or field confirmation samples, each sample may consist of multiple containers acquired from a single sample aliquot.

Sample Container - Any vessel used to contain a sample during the time between collection and analysis.

Sample Set - Will compose of one or more samples from a single facility. Each sample will represent a single sampling point.

Sampler(s) - Same as sampling crew.

Sampling Crew - The person or persons charged with the responsibility to properly acquire representative groundwater samples from the facility's groundwater monitoring system.

Sampling Day - Period of time in a calendar day during which the sampler is involved with activities concerning the sampling at the facility. This includes any activity with the sampling equipment after the first sample has been acquired on behalf of the facility for the purpose of monitoring the groundwater.

Sampling Event - Refers to all activities relating to the legal acquisition of samples of groundwater for the purpose of groundwater monitoring as prescribed in 329 IAC 10-21-2. Included in addition to active acquisition of the groundwater samples are all blanks and duplicates, field documentation, transport, custody record, and analytical records and results. The sampling event officially ends when the results of the analysis are received by the Office of Solid and Hazardous Waste.

Specific Conductance - The ability of water to conduct electrical current. This is expressed in terms of microohms/cm this measurement gives a gross dissolved ion reading relative to the charge and concentration.

Well Cap - A fitted covering for the well riser. The cap will be in place whenever the well is not in use. The cap may be of any material compatible with the well riser material. The cap will be vented on either top or side to allow air circulation into and out of the well riser. The cap and vent will be designed to discourage the flow of rain and surface waters down the well riser from the top. Well caps must be removable by hand.

Well Development - One of several methods intended to remove the free sediment from the bottom of groundwater monitoring well. These methods include bailing until the water clears, or pumping the well with a sediment tolerant pump until the water clears, or surge development by forcing a volume of water or air into the well at pressure to push fine sediment away from the well filter, or a combination of surge and withdrawal until water does not show suspended sediment. These procedures should be employed whenever a well shows an accumulation of sediment (silt) in the well. The accumulation, is best evidenced by a change in the overall well depth without a corresponding change in the height of the well riser. Care will be executed in which development scheme is used to prevent introduction of chemicals into the groundwater. See well development requirements under 329 IAC 10-21-4 and guidance on monitoring well construction-damage and maintenance.

Table 1
Summary of Monitoring Well Network
Feddeler Construction/Demolition Site
Lake County, Indiana

Well ID	Total Well Depth (feet)	Screen Length	Top of Casing Elev (ft-MSL)
MW-1*	35.1	5	702.80
MW-2	30.7	5	675.30
MW-3	31.5	3	688.65
MW-4	28.0	3	702.71
MW-5*	35.8	3	706.96
MW-6*	33.9	5	695.97
MW-7	36.0	5	673.55
MW-8*	67.0	5	703.44
MW-9	56.0	5	674.59
MW-10	43.8	5	673.93
MW-11	23.3	5	682.40

*indicates upgradient well

Table 2
Sampling Containers and Preservatives
Feddeler Construction/Demolition Site
Lake County, Indiana

Parameter	Container Material (size)	Preservative Recommended
pH	Field Measurement	none
Specific Conductance	Field Measurement	none
Chloride	P, G (1000 mL)	Cool to 4° C
Sulfate	P, G (1000 mL)	Cool to 4° C
Ammonium	P, G (500 mL)	H ₂ SO ₄ to pH < 2
Dissolved Metals Analysis: Sodium Arsenic Barium	T,P (500 mL)	Immediately Field filter with 0.45 micron filter membrane, then acidify to pH <2 with HNO ₃ cool to 4° C
VOC's	Glass (40 mL VOA Vial)	No head space in vial Teflon Coated Septum in lid (HCl pH <2)

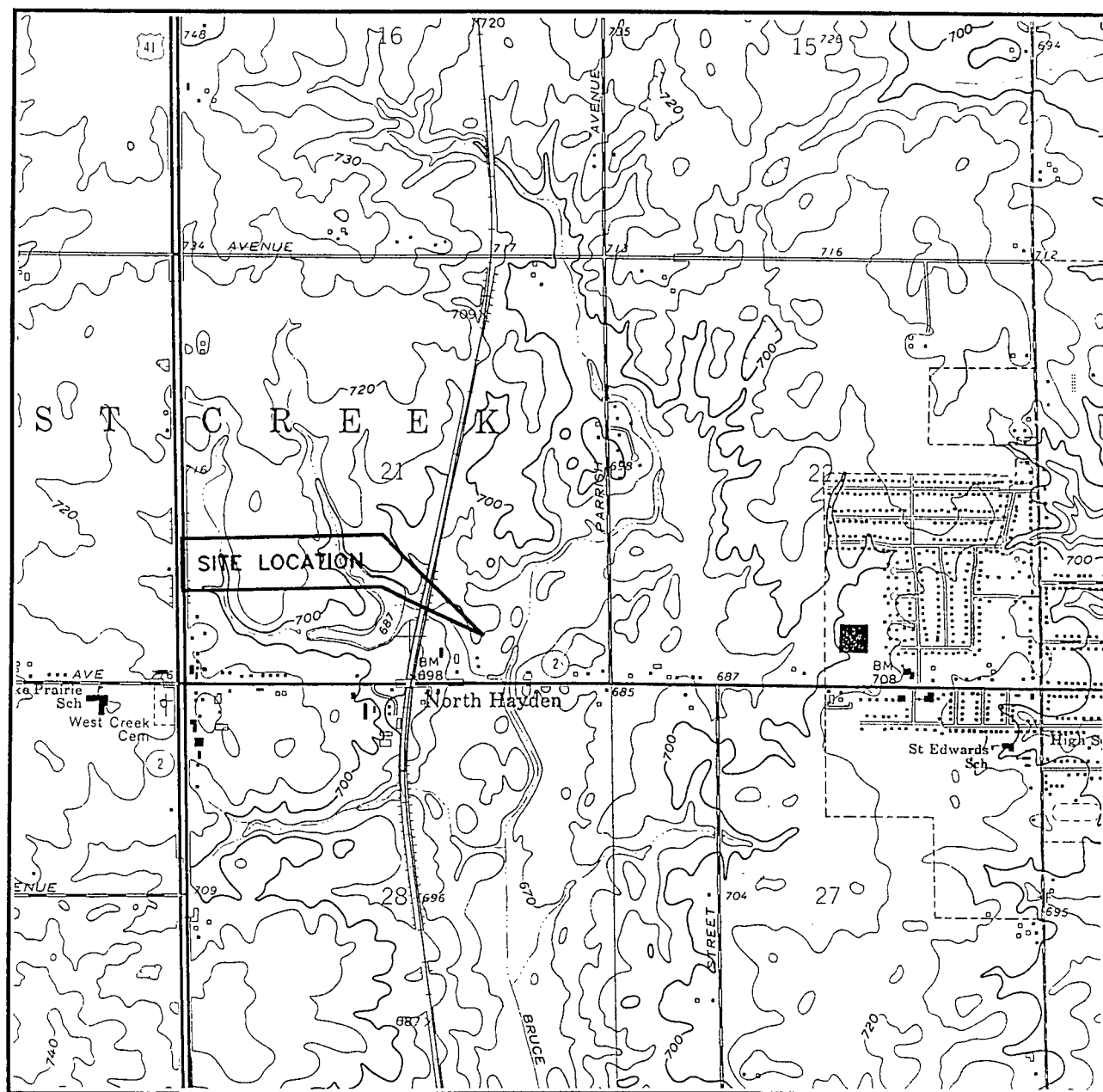
P-Plastic (polyethylene)
G-Glass (usually amber)

T- Fluorocarbon resins (PTFE, Teflon, FEP, et al)

Figures

Weaver Boos Consultants, Inc.

200 South Michigan Ave.
Chicago, Illinois 60604
(312)922-1030
Fax (312)922-0201



ADAPTED FROM THE LOWELL, INDIANA, USGS
7.5 MINUTE SERIES QUADRANGLE, DATED
1980

COUNTOUR INTERVAL - 10 ft
SCALE - 1:24,000

SITE LOCATION MAP

Feddeler Construction/Demolition Site
Lowell, Indiana

WEAVER BOOS CONSULTANTS, INC.

CHICAGO, IL
(312) 922-1030

GRIFFITH, IN
(219) 923-9609

ALBUQUERQUE, MN
(505) 867-6990

PREPARED BY: MBM

DATE: 10/20/97

FIG. 1 OF 1

REVIEWED BY: LE

Fig1.doc

FIGURE 1

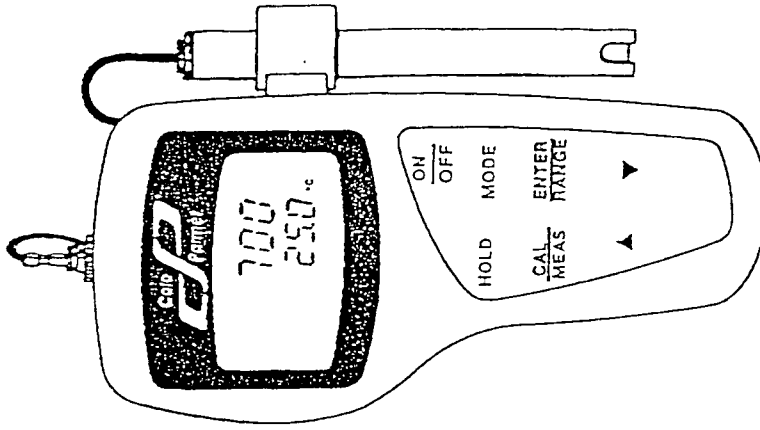
Appendix A

Owners/Operators Manuals for Sampling Equipment

Weaver Boos Consultants, Inc.

200 South Michigan Ave.
Chicago, Illinois 60604
(312)922-1030
Fax (312)922-0201

Cole-Parmer® 19815-00
Basic Conductivity Meter



Printed in the U.S.A. 19-L-R1

Cole-Parmer Instrument Company
625 E. Bunker Court, Vernon Hills, Illinois 60061-1844
1-847-549-7600 or Toll-free 1-800-323-4340
Fax: 1-847-549-7676 Telex: 28-9405

1. Introduction	Page 2
2. Keypad Functions	Page 2
3. Preparation	Page 2
4. Calibration	Page 3
5. Temperature Calibration	Page 4
6. Measurement	Page 6
7. Probe Care and Maintenance	Page 7
8. Error Messages	Page 9
9. Troubleshooting	Page 9
10. Specifications	Page 10
11. Accessories	Page 10
12. Warranty	Page 11
13. Return of Items	Page 12

1. Introduction

Thank you for selecting the Cole-Parmer® 19815-00 conductivity meter. Included with your meter is an epoxy platinum probe with built-in temperature sensor and cable, a built-in four position probe attachment and a built-in meter stand.

2. Keypad Functions

See Figure 1, right.

The keypad is easy to use. The LCD has a primary and secondary display. The primary display shows the measured conductivity reading in μ S. The secondary display shows the temperature of the reading in $^{\circ}$ C. Both displays show error messages, keypad and program functions.

Keypad functions

ON/OFF Powers and shuts off the meter. Meter goes into measurement mode when turned on.

HOLD Freezes the measured readings. To activate, press HOLD while in the conductivity measurement mode. To release, press HOLD again.

MODE Select one of two measurement modes: COND (conductivity),

CAL/MEAS Enters the Calibration function.
ENTER/RANGE Confirms your values. Switches to manual ranging and can scroll to your selected measurement range for conductivity only.

▲ or ▼ Scrolls up or down to the values you want.

3. Preparation

Inserting the batteries (included)

1. Use a Phillips screwdriver to remove the two screws holding the battery cover. See Figure 2, right.
2. Lift meter stand to expose battery cover.
3. Remove battery cover.
4. Insert batteries. Follow the diagram inside the cover for correct polarity.
5. Replace the battery cover into its original position using the screws removed earlier. Replace the meter stand in the folded position.

Connecting the Probe and Temperature Sensor

Note: Keep connector dry and clean. Do not touch connector with soiled hands.

1. Slide the probe connector over the BNC connector on the meter. Make sure the connector slot aligns with the posts of the socket. See Figure 3, right.
2. Rotate the connector clockwise until it locks. Do not force.

Temperature sensor. The temperature sensor uses a phono jack to connect with the socket on the meter. Insert the jack into socket as shown in Figure 4, right.

Inserting conductivity/temperature probe into the electrode holder

The meter includes two probe holders. Do not use excessive force when inserting probes into the holders.

1. Align the end of the probe (sensor side) with the hole

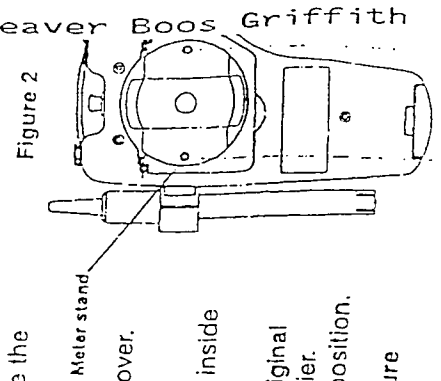


Figure 2

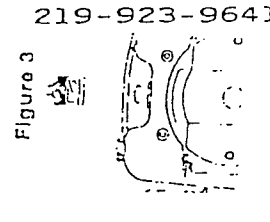


Figure 3

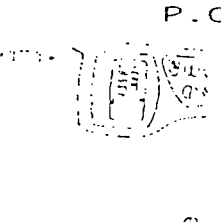


Figure 4

2. Insert the probe into the hole of the holder until the top housing of the probe touches the top of the holder.

Figure 5

Attaching the electrode holder to the meter

1. Place the probe holder with the flange facing the slot on the meter. See Figure 5, right.
2. Gently slide the holder flange in the slot. Make sure holder is fixed properly into slot. You can attach the probe holder in different positions, as shown in Figure 6, right. This flexibility helps one-hand operation.

Figure 6

Connecting the optional AC adapter

1. Insert the AC jack as shown in Figure 7, below. This helps conserve batteries but is not required for operation.
2. Switch off the meter before plugging the adapter into the power source. This safety precaution protects the memory in your meter.
3. Press the ON/OFF button to switch the power ON.

Figure 7

4. Calibration

Select a conductivity standard near the sample value you are measuring.

The next best method is to choose a calibration solution value that is approximately 2/3 the full scale (F.S.) value of the measurement range. For example in the 0 to 1999 μS range, use a 1413 μS solution for calibration. See "Specifications", page 10.

Preparing the Meter for Calibration

- Press the ON/OFF key

All the LCD segments display for a few seconds. The LCD switches to the conductivity measurement mode.

2. Press the MODE key to select your mode. Select one of the two calibration modes: COND (conductivity) or TEMP (temperature).

You only need one calibration for measurement of the entire range of the

closest range calibrated and uses the calibration information. However, only the ranges that have been calibrated have maximum accuracy.

If you are measuring in ranges greater than 20 mS or conductivity lower than 100 μS , calibrate the meter at least once a week to get specified $\pm 1\%$ F.S. accuracy. If you are measuring in the mid ranges, and you washed the probe in deionized water and stored it dry, calibrate the meter once a month. Wet the probe for 10 minutes before calibrating or taking readings to saturate the probe surface and minimize drift. If you make measurements at extreme temperatures, calibrate at least once a week.

Use only the conductivity probe specified for these meters. If you do not, you must measure the solution temperature separately and manually enter the solution temperature.

Calibrating for Conductivity

1. Pour out 2 separate portions of your calibration standard and one of deionized water into separate clean containers.
2. Press MODE and select COND. See Figure 8, right.
3. Rinse your electrode with deionized water then rinse in one of the portions of calibration standard.
4. Immerse the electrode into the other standard solution, and press CAL.

Figure 8

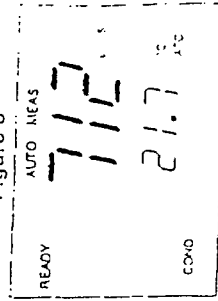
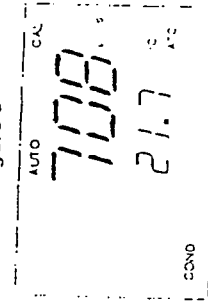


Figure 9



NOTE: Allow at least 5 minutes for the probes to equilibrate at the solution temperature. The display shows the CAL mode. "CAL" blinks on the display as long as the calibration mode is on. The primary (larger) display shows the measured reading and the secondary display shows the temperature. See Figure 9, right.

5. Enter value of your conductivity standard. The meter automatically compensates for temperature differences. Use the \blacktriangle or \blacktriangledown to scroll to your chosen standard value.
6. Confirm calibration by pressing ENTER/RANGE button. Upon confirmation, the CAL indicator stops flashing and remains on the screen for 3 seconds. The meter switches back into the measurement mode and the calibrated and temperature compensated value will be

NOTE: To exit from this process without confirming the calibration, press "CAL/MEAS".

See Figure 10, right.

- For calibration in other ranges (maximum: 5 ranges) repeat steps (1 through 5). But this time, use a solution with a conductivity in the different ranges.

Calibration Error

See Figure 11, right.

For conductivity calibration, "ERR" on the display shows whenever the calibration value input into the meter is different from the initial value displayed by more than 20%. "ERR" displayed warns you of improper probe use, or bad calibration technique.

5. Temperature Calibration

The built-in temperature sensor included in the probe is factory calibrated. Calibrate your sensor if you suspect temperature errors that may occur over a long period of time. If you got a replacement probe, see the calibration instructions. "Two Point Temperature Calibration" included with it. Use a known standard solution with your probe. Compare the value to that known standard or from the value of an NIST thermometer.

- Press MODE and select temperature mode (TEMP). Make sure you are in MEAS before you begin software calibration. See Figure 12, right.

- Press CAL.

Pressing CAL brings you into the calibration mode. The primary display shows the measured Conductivity value, and the secondary display shows the temperature at factory calibration value. See Figure 13, right.

Figure 10

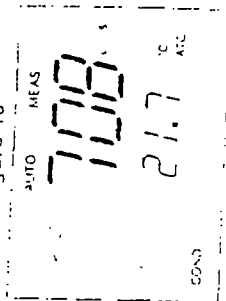


Figure 11

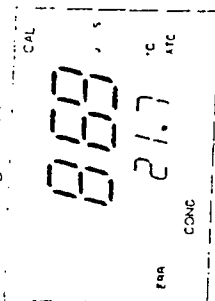


Figure 12

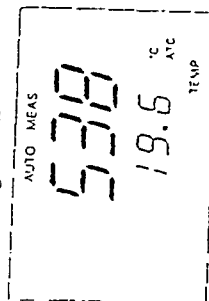
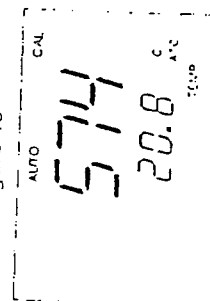


Figure 13



- Press ▲ or ▼ to adjust the reading to agree with your temperature standard.

NOTE: Temperature calibration with the probe is restricted to $\pm 5^{\circ}\text{C}$ from the initial value displayed during calibration. However, without the probe, you can set any temperature between 0.0 to 80.0°C for manual temperature compensation. Manual temperature value is stored in memory and can be recalled.

In Figure 14, right, the desired temperature is 22.0°C . Use the ▲ to increase the temperature reading to 22.0°C .

- Press ENTER/RANGE to confirm your selected correct temperature. The meter reverts to the measurement mode. The meter is now prepared for temperature compensation. See Figure 15, right.

Calibration Error

When an error occurs during the calibration procedure, ERR displays.

For temperature calibration, the "ERR" displays once the calibrated value input exceeds the initial display value by 5°C . The "ERR" also prevents bad calibration technique and improper temperature sensor use.

6. Measurement

The READY mode shows the readings stabilize within a range of ± 1 unit/15 seconds. When this occurs, the READY annunciator appears on the top left corner of the display. The reading holds until the measured value exceeds the specified range and the READY annunciator turns off. To measure in the mode, do the following:

- Rinse the electrode with deionized or distilled water before use to remove any impurities adhering to the electrode body.

- Switch on the meter.

The MEAS annunciator together with the auto-ranging annunciator (AUTO) displays on the top center of the LCD. See Figure 16, right.

Figure 14

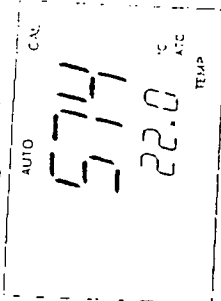


Figure 15

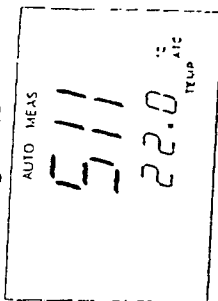
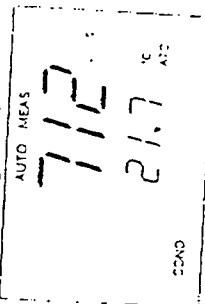


Figure 16



7. Probe Care and Maintenance

Keep the conductivity probe clean. Rinse the probe twice, and gently swirl it while you take readings. For the best accuracy, soak a dry probe for at least 5 to 10 minutes or longer before calibration. Wash the probe with deionized or tap water before storing it. Never scratch the platinum portions with a hard substance. Do not strike the probe against any hard surface.

Do not make continuous contact with your solutions. Readings rise over a continuous period of time if you soak your probe.

Do not immerse the probe in oily solutions. Clean the electrode thoroughly by immersing it in an agitated mild detergent bath. Wipe the probe with a soft tissue paper. Wash thoroughly in tap water and then in deionized water. Recalibrate the meter after cleaning it.

8. Error Messages

LCD Display	Indicates	Cause	Solution
Err. 1 (in primary display)	Memory write error	Instrument too old (> 10 years). Hardware failure	Return*
Err. 2 (in primary display)	Memory checksum error	Batteries too weak. Hardware failure.	Press ENTER, then turn off meter. Change batteries. Recalibrate. Return*
Err annunciator	Unrecognized input from keypad	Wrong input in selected mode.	Release key. Select valid operations depending on mode. Return*
CAL & Err annunciators blink	Calibration error	Wrong value input at calibration. Dirty probe	Check value, clean probe. See "Probe Care and Maintenance" above. Return*
Err. 3	ADC error	Faulty hardware	Return*
Err. 4	Keypad stuck error	Faulty hardware	Return*

You will see the errors in the primary display (the row of larger digits). To eliminate the errors, switch off the meter and switch it ON again. All keys become inactive. If error persists, or the meter shows incorrect values, return the meter.

* See "Warranty" and "Return of Items"

NOTE: When dipping the electrode into the sample, make sure the tip of the probe is completely immersed into the sample. Stir the electrode gently in the sample to create a homogenous sample. Make sure there are no air bubbles trapped in the slot of the probe. To remove air bubbles, give the probe a gentle shake making sure the electrode tip is submerged.

Figure 17

ATC READS

71.2
11.2
21.7

4. Take readings.

When the reading is stable, a READY annunciator displays. See Figure 17, left.

NOTE: For ATC measurements, attach the temperature sensor connector to the conductivity meter. The ATC annunciator lights up. Insert the probe into the solution to be measured so the sample temperature can be recorded and compensated. Allow a few minutes for the temperature reading to come to equilibrium with the solution.

Hold

1. Press HOLD to freeze a measurement.

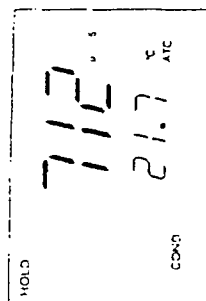
When HOLD mode is activated, the HOLD mode annunciator displays.

See Figure 18, right.

Release a held value

1. Press HOLD again and get "live" readings. The Hold annunciator disappears from the LCD.

Figure 18



Temperature Normalization and Temperature Coefficient

The conductivity of solution varies greatly with temperature. The automatic temperature compensation (ATC) of the conductivity meters adjusts conductivity measurements to eliminate the conductivity changes caused by temperature. Readings are usually referenced to or normalized at a standard temperature (25°C), and ATC gives the corrected readout of the equivalent conductivity solution normalized to 25°C.

Specifications continued

Power: 4 1.5V batteries (AAA), approx. 60 hrs. or 9 VDC
unregulated AC adapter

Operating temperature: 0 - 50°C

Dimensions:

meter: 7.5"L x 3.5"W x 1.75"H (187.5 x 87.5 x 43.75 mm)
boxed: 9.2"L x 8.5"W x 2.75"H (230 x 212.5 x 68.75 mm)
probe only: 1/2"Dia. x 5"L with 2.5 ft cable (12.5 x 125 mm)

Weight:

meter: 1 lb (0.5 kg)
probe: 0.35 lb (0.2 kg)
complete kit: 2 lbs (0.9 kg)

11. Accessories

MN-59002-51 110 VAC Adapter
MN-59002-56 220 VAC Adapter
MN-59002-92 Replacement Electrode Holder
MN-01489-41 23 µS Cal. Standard, 1 qt
MN-01491-85 84 µS Cal. Standard, 500 ml
MN-01489-43 447 µS Cal. Standard, 1 qt
MN-01482-70 1413 µS Cal. Standard, 500 ml
MN-01489-44 2070 µS Cal. Standard, 1 qt
MN-01482-71 2764 µS Cal. Standard, 500 ml
MN-01481-52 12880 µS Cal. Standard, 500 ml
MN-19850-00 447 µS Cal. Standard, 20 single use pouches
MN-19850-10 1413 µS Cal. Standard, 20 single use pouches
MN-19850-20 2764 µS Cal. Standard, 20 single use pouches
MN-19850-30 15,000 µS Cal. Standard, 20 single use pouches
MN-19815-50 Replacement cell for 19815-00

9. Troubleshooting

Problem	Cause	Solution
Power on but no display	a) Batteries not in place. b) Batteries not in correct polarity. c) Weak batteries.	a) Insert batteries. b) Re-Insert batteries in correct polarity. c) Replace batteries or attach AC adapter.
Unstable reading	a) Dirty probe. b) Low conductivity. c) External noise pickup. d) Broken probe.	a) Clean the probe and recalibrate. b) Avoid atmospheric contact with solution. c) Move away from noise. d) Replace probe.
Not able to calibrate	a) Dirty/Oily probe. b) Incorrect probe cell constant.	a) Clean probe. See "Probe Care & Maintenance", p. 9 b) Replace probe.
"Err" on LCD, printer or computer screen	a) Probe is shorted. b) Probe in too high conductivity solution for range.	a) Check probe b) Use different solution

10. Specifications

Ranges:	Conductivity	Temperature
	0.00 - 19.99 µS	0 - 80°C (Platinum probe)
	0.0 - 199.9 µS	
	0 - 1995 µS	0 - 100°C (Glass/Platinum probe)
	0.00 - 19.99 mS	
	0.0 - 199.9 mS	
Resolution:	0.01 µS	0.1°C
	0.1 µS	
	1 µS	
	0.01 mS	
	0.1 mS	

Accuracy: ±1% F.S.

Cell constant: 1

Temperature compensation: auto or manual

Reference temperature: factory set at 25°C

Temperature coefficient: factory set at 2% per °C.

The Cole-Parmer Instrument Company warrants this product to be free from significant deviations in material and workmanship for a period of one year from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse within the one year period, please return-freight prepaid-and correction will be made without charge. Cole-Parmer alone will determine if the product problem is due to deviations or customer misuse.

Out-of-warranty products will be repaired on a charge basis.

13. Return of Items

Authorization must be obtained from our Customer Satisfaction Department before returning items for any reason. When applying for authorization, please include data regarding the reason the items are to be returned.

For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. Cole-Parmer will not be responsible for damage resulting from careless or insufficient packing. A restocking charge will be made on all unauthorized returns.

NOTE: The Cole-Parmer Instrument Company reserves the right to make improvements in design, construction and appearance of our products without notice.

Cole-Parmer · Reg TM Cole-Parmer Instrument Co.



806-00

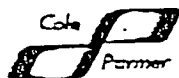
Cole-Parmer Instrument Company

625 E. Bunker Court, Vernon Hills, Illinois 60061-1844

1-847-549-7600 or Toll-free 1-800-323-4340

Fax: 1-847-549-7676 Telex: 28-9405

5938-JD

Digi-SENSE®Digital
pH / mV / ORP Meter**Operating Manual**

Cole-Parmer Instrument Co.

7425 North Oak Park Ave.

Chicago, Illinois 60648

1-708-647-7600

1-800-323-4340

TABLE OF CONTENTS

Title	Page
GENERAL INFORMATION	2
OPERATING TIPS	2
Front Panel Controls	2
pH Calibration	3
OPERATION	3
Temperature Compensation	3
Battery Replacement	4
Cleaning the Probe	4
TROUBLESHOOTING	4
SPECIFICATIONS	5
WARRANTY	5
RETURN OF ITEMS	5
TECHNICAL ASSISTANCE	6

GENERAL DESCRIPTION

This portable, Digital pH Meter is designed with solid state electronics providing highly reliable operation. The LCD display enables you to read even under bright ambient conditions. It is designed for pH (manual), millivolt and ORP determination.

OPERATING TIPS

For fast response, the glass bulb of the probe should always be kept moist. A rubber cap is supplied with the probe to store a small amount of solution and to cover the glass bulb.

Before use, remove the cap. If the cap has been left off and the tip of the probe is dry, dip the probe in KCL solution for 30 minutes or soak in tap water for 2 hours.

When the electrode is not in use, replace the cap which should be filled with KCL or equivalent probe storage solution. If a solution is not available, use tap water.

NOTE: Do not use distilled or deionized water for storing, under any circumstances.

Front Panel Controls

The features on the front panel are:

1. ON/OFF key
2. (pH/mV) key
3. SLOPE adjustment
4. Manual temperature adjustment
5. Standardize control
6. pH probe input
7. LCD display

pH Calibration

Calibration with manual temperature compensation.

1. Press ON/OFF key to turn meter on.
 2. Connect the pH probe to the meter.
 3. Immerse the probe in buffer 7.00.
 4. Press the pH/mV key to select pH.
 5. Adjust temp °C control to the temperature of buffer 7.00.
- NOTE: A separate thermometer is needed to measure the temperature of the buffers. Both buffers should be at the same temperature.
6. Adjust the standardize control to read 7.00 pH on the display.
 7. Rinse the probe with distilled water and blot dry.
 8. Immerse the probe in the second buffer (4.00 or 10.00).
 9. Adjust the temp °C control to the temperature of the second buffer.
 10. Allow the reading to stabilize, then adjust the SLOPE control to the value of the second buffer.
 11. Rinse the probe with distilled water.

Calibration is now complete.

OPERATION

1. Push the ON/OFF key to turn the meter on.
2. Push the pH/mV key until the annunciators indicate the desired mode.

For pH measurement: Rinse the probes with distilled water, then immerse the probe in the solution to be measured. The pH value will stabilize after a few seconds. Do not rub the bulb as this will cause static build-up on the bulb resulting in faulty readings.

Temperature Compensation

Temperature compensation can be set manually by the temperature °C adjustment over a range of 0° to 100° C.

For millivolt or ORP measurement: Press the pH/mV key until the display shows millivolts. Verify the probe connection, then rinse the probe with distilled water and blot dry. Immerse the probe in the sample to be measured. Allow the displayed reading to stabilize, then take the reading.

Battery Replacement

The pH meter uses a 9 volt battery with a life of 2000 hours. If the low battery indicator is on, stop operation and replace the internal battery with a new 9 volt battery.

Cleaning the Probe

The glass bulb is the sensitive part of the probe, it should always be kept clean. Rinse the probe with distilled water after use. Before storage, rinse the probe with tap or distilled water, shake dry and place the probe in the protective cap which should be filled with a KCL solution or equivalent probe storage solution.

If KCL or equivalent storage solution is not available, use a 4.00 pH buffer, 7.00 pH buffer or tap water.

NOTE: Distilled or deionized water should never be used.

TROUBLESHOOTING GUIDE

SYMPTOMS	PROBLEM	POSSIBLE SOLUTION
Meter will not calibrate or gives erroneous readings	Defective pH probe, bad buffer, or incompatible sample	1. Change buffer 2. Check chemical compatibility 3. Replace pH probe
Unit gives slow response or erroneous readings	Dry electrode or clogged reference junction in pH probe	1. Clean the probe 2. Replace pH probe
Meter will not accept second buffer	Defective pH probe or bad buffer	1. Change buffers 2. Clean probe 3. Replace probe
Reading drift on display	Bad pH probe or incompatible sample being measured	1. Clean probe 2. Check chemical compatibility of sample with probe 3. Replace probe
Low Bat Indicator is lit	Low Battery	Replace battery

SPECIFICATIONS

Ranges:	
pH:	0.00 to 14.00
mV:	-1999 to +1999
Resolution:	
pH:	0.01
mV:	1. mV
Accuracy:	
pH:	±0.01 pH
mV:	±1 mV
Temp Compensation:	Manual, from 0° to 100° C
Battery:	9 volt (included) battery life: 2000 hrs.
Display:	4 digit LCD, 1/2" high
Input Impedance:	Greater than 10 ¹² ohms
Dimensions:	6 5/8"L x 3"W x 2 9/32"D

WARRANTY

We warrant this product to be free from defects in material and workmanship for the period noted in the enclosed Warranty Card. If repair or adjustment is necessary, which has not been the result of abuse or misuse within the warranty period, please return, freight prepaid. Correction of the defect will be made without charge. (See Return of Items below.)

For your protection, items being returned must be carefully packed to prevent damage in shipment. Also insure against possible damage or loss. We will not be responsible for damage resulting from careless or improper packing.

Out-of-warranty products will be repaired for a nominal charge.

RETURN OF ITEMS

Authorization must be obtained from your Dealer before returning items for any reason. When applying for authorization, please include the reason the items are to be returned.

TECHNICAL ASSISTANCE

Technical Information and advice concerning the use of the product in specific applications may be obtained. Modifications can often be made to adapt the unit to special applications. Contact your Dealer for information.

The manufacturer reserves the right to make improvements in design, construction and appearance of the product without notice.

Appendix B

Laboratory QAPP

Weaver Boos Consultants, Inc.

200 South Michigan Ave.
Chicago, Illinois 60604
(312)922-1030
Fax (312)922-0201



LABORATORY
QUALITY ASSURANCE PROJECT PLAN (QAPP)

Revision 4.0
January 21, 1997

TABLE OF CONTENTS

1.0	Program Description	
2.0	Organization and Responsibility	
-	Major Equipment	
-	Organizational Chart	
-	Key Personnel Resumes	
3.0	Quality Assurance Objectives	
-	Duplicate Control Limits	
-	MS/MSD Control Limits	
-	Surrogate Spike Control Limits	
4.0	Analyst/Technician Training Program	
-	Training Program Forms	
5.0	Sample Custody	
-	Sample Custody SOP	
-	Example Custody Documents	
-	Preservation and Containers Table	
6.0	Calibration Procedures and Frequency	
-	Procedure and Frequency Tables	
-	Acceptable Limits	
-	Accuracy and Traceability of Standards	
7.0	Analytical Method	
-	Compounds List With Methods and PQL's	
8.0	Data Reduction, Validation and Reporting	
-	Deliverables Content List	
-	Data Validation Summary Form	
9.0	Internal Quality Control	
10.0	Performance and System Audits	
11.0	Preventative Maintenance	
-	Frequency Table	
12.0	Specific Routine Procedures used to Assess Data Precision, Accuracy and Completeness	
13.0	Corrective Action	
-	Situation-Out-of-Control	
14.0	Quality Assurance Reports to Management	
Appendix A: Two Most Recent WP Results		
Appendix B: Certification		
Appendix C: Equipment, Facility Lay-out		

1.0 PROGRAM DESCRIPTION

- 1.1 This program was designed to insure the quality and integrity of data generated by SIMALABS International. The requirements herein apply to all personnel with the organization that directly or indirectly generate analytical results.

It is our responsibility to generate data where the level of precision, accuracy, completeness and representativeness are known and documented. This responsibility is held by all personnel of the organization, and assured with constant oversight by management.

This document discusses all aspects of the laboratory operation and its personnel. Discussion of quality control limits, responsibilities, audits and pertinent procedures are contained within.

Due to the constantly changing nature of our business, the contents and limits discussed may change. SIMALABS International believes in continually improving our operations. Documentation of these improvements will be handled through revision of this document.

As of the date of last revision on this QAPP, the contents can be considered policy of SIMALABS International. Management and staff level personnel will strive in every way to insure that its contents are accurate and upheld for all data generated.

2.0 ORGANIZATION AND RESPONSIBILITY

2.1 Introduction

The laboratory QAPP is under the direct supervision of the Quality Control Officer (QCO). His decisions concerning the validity of data are final and receives complete support of the company's President. Any questions concerning the validity of the data will be addressed to its origin and the Assistant Laboratory Manager will take immediate action to correct.

The complete organization structure of SIMALABS International is shown in Figure 2.1.

2.2 Support

2.2.1 *President/Laboratory Manager*: Oversees all operations within the organization. He enforces the guidelines of the QAPP through the Laboratory Manager.

2.2.2 *Assistant Laboratory Manager*: Controls production of all analyses and oversees that the correct procedures are implemented. He also reviews the final reports before going to the client.

2.2.3 *Quality Control Officer*: Reviews and approves all data generated by laboratory personnel, maintains control charts and Quality Control records documenting blanks, duplicates, spikes and all other aspects of the QAPP.

2.2.4 *Sample Custodian*: Signs in all samples and determines that all Chain of Custody (COC) forms are properly filled out. He stores all samples and distributes them to proper personnel daily.

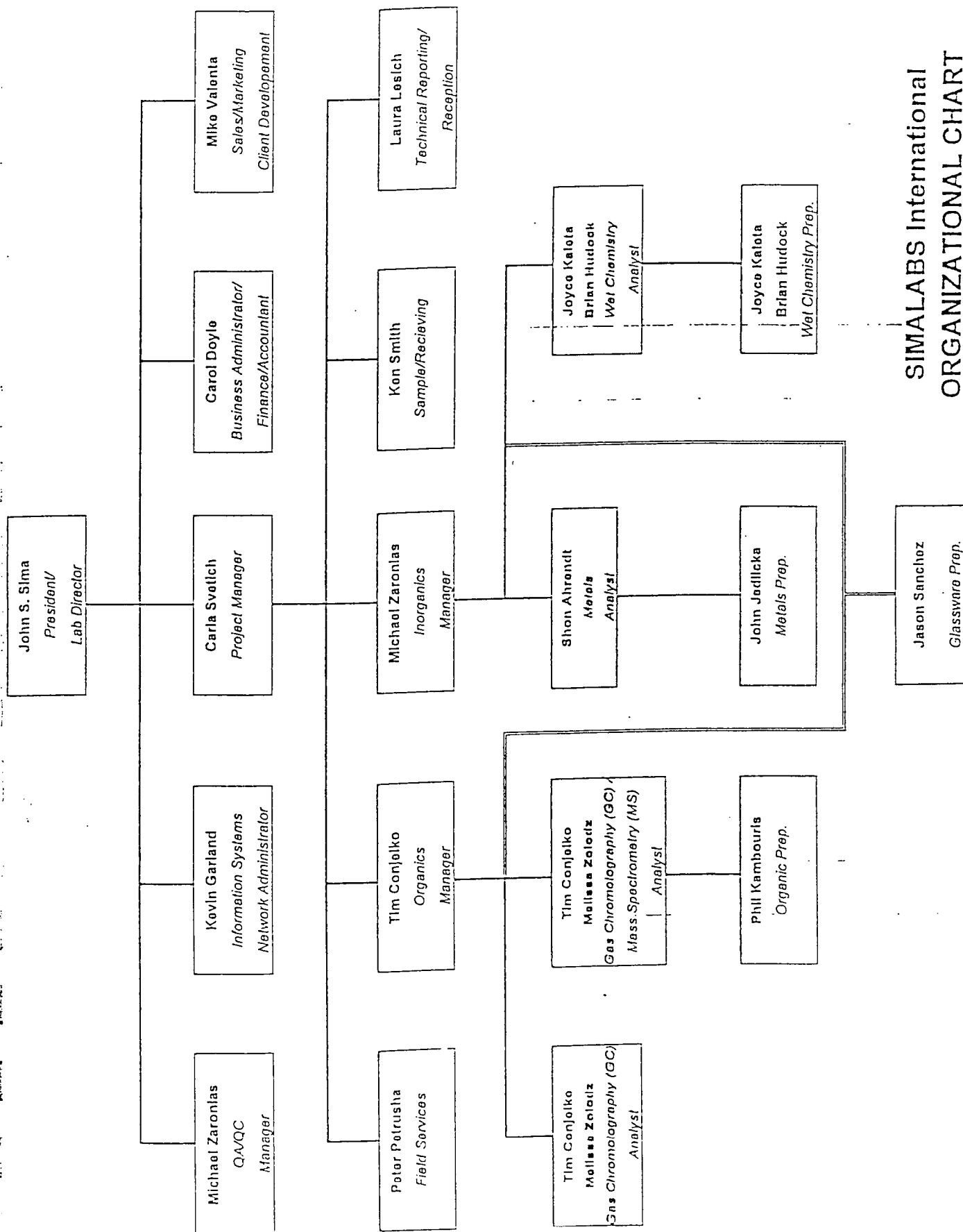
2.3 Resumes of Personnel

See following pages.

Equipment List

Instrument	Manufacturer	Model	Date of Purchase	Detectors
GC/MS	Hewlett Packard	5971 / 5890 Series II	1991	MSD
GC/MS	Hewlett Packard	5971 / 5890 Series II	1992	MSD
GC	Hewlett Packard	5890 Series II	1991	FID/ECD
GC	Hewlett Packard	5890 Series II	1995	ECD
GC	Hewlett Packard	5890 Series II	1995	FID
Large & Trap	Tekmar	LSC2000 / ALS2016	1991	N/A
HPLC	Perkin-Elmer	250 Binary Pump 235C - Photodiode Array LC240 - Fluorescence	1993	PDA / Fluorescence
ICP	Thermo Jarrel Ash	IRIS	1994	CID
	Varian	SpectrAA 400	1993	Furnace
	Varian	SpectrAA 20 +	1992	Flame/CV
IR	Perkin Elmer	683 - IR	1991	IR
Spectrometer	Milton Roy	Spectronic 20D	1991	Spec
FIA Automated Ion Analyzer RadiDist	Lachat	QuickChem 8000	1996	Photometric / Conductivity
Concentrator	Zymark	TurboVap II	1995	N/A
Analytical Balance	Mettler	AE - 100	1991	N/A
Top Loading Balance	Mettler	XL - 1800	1994	N/A
Top Loading Balance	Mettler	XL - 500	1994	N/A
pH Meter	Fisher Scientific	Accumet pH Meter - 25	1994	N/A
Horn - type Probe Sonicator	Bransen	Sonifer 450	1994	N/A
Bath Sonicator	Fisher Scientific	Ultrasonic FS - 14	1991	N/A
Centrifuge	Int'l Equipment Co.	Centra - HN	1991	N/A
Shen	Fisher Scientific	655 - F	1994	N/A
Oven	Baxter / S - P	NB620 - 10A	1991	N/A
Furnace	Thermolyne	1300	1992	N/A
CLP Agitator	Analytical Testing	8 Station	1991	N/A
ZHE Extractors	Analytical Testing	Pressured Stain. Steel	1991	N/A
CLP Filtration Device	Analytical Testing	Pressured Stain. Steel	1991	N/A
Flashpoint Apparatus	Precision Scientific	24537	1991	N/A
Vacuum System	Welch	1376	1994	N/A
Fume Hoods	Fisher Hamilton	Various	1991 to 1994	N/A

In addition to the above, a diagram of SIMALABS International facilities can be found attached to this proposal as Appendix C



SIMALABS International ORGANIZATIONAL CHART

JOHN S. SIMA
President/Laboratory Director

EDUCATION:

B.S., Chemistry, University of Iowa, Iowa City, Iowa, 1986

PROFESSIONAL ASSOCIATIONS:

American Chemical Society

Federation of Environmental Technologists, Inc.

International Association of Environmental Laboratories

PUBLICATION:

"Antiinsectan Aflanine Derivatives from the Sclerotia of *Aspergillus Flavus*"; James B. Gloer, Mark R. TePeske and John S. Sima; the Journal of Organic Chemistry, 1988, Vol. 53.

EXPERIENCE:

Mr. Sima, as President and Laboratory Director for SIMALABS International, has the responsibilities for the overall management of office and laboratory. Mr. Sima currently manages the operation of the laboratory which consists of the production, method development, QA/QC, finances, reports, purchases and marketing.

Since opening his own laboratory in 1991, Mr. Sima has developed numerous analytical projects including those for clientele such as Avery International, American Steel Foundries, BorgWarner Automotive, Bethlehem Steel Corporation, Crown International, Inc., Hammond Lead Products, Inc., Knauf Fiber Glass, McGill Manufacturing, National Standard Company, National Steel Corporation, Riverwood International (Division of Monsanto) and Urschel Laboratories. He has also developed a clientele base of many environmental engineering firms as well. Mr. Sima developed a relationship with IDEM through the first four years of SIMALABS International which contributed to a contract award in 1995.

Before forming A₂I, Mr. Sima managed the laboratory for ATEC Associates, Inc. in Griffith, Indiana for one year and worked in ATEC's Indianapolis laboratory for four years. His experience at ATEC Associates, Inc. included operating several pieces of instrumentation, including GC-FID for Total Petroleum products, GC-ECD for PCB/Pesticides analysis, GC/MS for Volatile and Semi-Volatile organic compounds, Atomic Absorption for Trace Metal analysis and various wet chemistry devices. Mr. Sima also managed the GC/MS department for one year.

While at ATEC, Mr. Sima had opportunities to work with project engineers which gave him valuable knowledge in UST, RCRA and CERCLA projects. Those projects included many clients such as Illinois Bell, AT & T, W.W. Grainger,

Westinghouse (Bloomington, Indiana), F.M.C. Corporation, Indiana Naval Weapons Support Center, IDEM, Gillette and many other clients.

Prior to his association with ATEC, Mr. Sima was employed by the University of Iowa Hygienic Laboratory where he had the opportunity to work for the U.S. EPA using strict CLP Protocol. Mr. Sima's responsibilities included Organic preparation of Semi-Volatiles, PCB's and Pesticides. He also operated the GC/ELCD/PID instrumentation for Volatile Halocarbons analysis.

MICHAEL ZARONIAS
Chemist

EDUCATION:

B.A., Chemistry, Indiana University, Northwest, Gary, Indiana, 1989

EXPERIENCE:

Mr. Zaronias is currently responsible for running the laboratory quality control program. His background in organics and inorganics allows him to monitor the quality of all analysis conducted. He monitors data quality using control charting. Mr. Zaronias is responsible for guaranteeing adherence to the QAPP through audits, PE samples, and data review. The results of his efforts are reported to management on a regular basis.

Mr. Zaronias analyzed samples for PCB's and Pesticides using GC and TPH samples by GC and IR. He has some training for the analysis of SVOC's and VOC's. Mr. Zaronias has experience in extracting soil, sludge and aqueous samples for PCB/Pesticides, SVOC, PNA and Herbicides analysis.

Mr. Zaronias was responsible for operation and maintenance of the Graphite Furnace Atomic Absorption Spectrometer, Inductively Coupled Plasma Spectrometer, and preparation of standards and digestates for metals analysis.

Additionally, Mr. Zaronias was responsible for overseeing analysis for cyanide, phenol, ammonia, nitrates, phosphorus, fluoride, chloride, sulfate and various other wet chemistry techniques.

Mr. Zaronias was previously employed by Northern Laboratories, an environmental laboratory, for nearly two years. He prepared samples for analysis by ICP, GFAA, FLAA and Cold Vapor Technique. Mr. Zaronias operated a Thermal Jarrell Ash ICP 9000, Perkin Elmer GFAA 5100 and Varian GFAA 400. He acquired a strong background in environmental testing using CLP Protocol.

Throughout his years as a chemist, Mr. Zaronias has had opportunities to work for clients such as U.S. EPA, Indiana Department of Environmental Management, U.S. Steel Corporation, Indiana Industrial Plating, Rockwell, Hammond Lead Products, Inc. along with many other clientele.

Prior to working for Northern Laboratories, Mr. Zaronias was a laboratory assistant at IUN, where he supervised and instructed students with laboratory techniques in the Organic chemistry lab.

Mr. Zaronias has over seven years experience as a chemist.

TIM CONJELKO
Chemist

EDUCATION:

B.S., Biochemistry, Purdue University, West Lafayette, Indiana, 1990

EXPERIENCE:

Mr. Conjelko is responsible for operation and maintenance of the Gas Chromatograph Mass Spectrometer systems for SIMALABS International. He is also responsible for operation and maintenance of a Gas Chromatograph having a Flame Ionization Detector and an Electron Capture Detector along with a High-Performance Liquid Chromatograph having a UV and Fluorescence Detector. His five years of experience at includes qualitative and quantitative analysis of priority pollutants and hazardous substances as labeled by the U.S. EPA according to current U.S. EPA CLP Protocol. In addition, Mr. Conjelko has the responsibility of prepping samples of different matrices using Liquid/Liquid and Liquid/Solid extraction methods.

Mr. Conjelko was previously employed by ATEC Associates, Inc. for one year at their Griffith, Indiana location. He was responsible for operation and maintenance of the Gas Chromatograph PID/ELCD, analyzing for Volatile Organic compounds and Total Petroleum Hydrocarbons. He also operated the Dohrmann TOC and TOX analyzer, screening samples for Organic Carbon and Organic Halides. He prepared samples of different matrices using Liquid/Liquid and Liquid/Solid extraction methods.

Mr. Conjelko has had opportunities to work on analytical projects including those for clientele such as National Steel Corporation, Illinois Bell, Shell Oil, W.W. Granger, Cook County, Illinois, Knauf Fiber Glass, Riverwood International (Division of Monsanto), Northern Indiana Public Service Company, Avery-Dennison and many other clients.

SHON AHRENDT
Chemist

EDUCATION:

B.S., Biology, Purdue University, West Lafayette, Indiana, 1991

EXPERIENCE:

Mr. Ahrendt's present duties include operation and maintenance of the Graphite Furnace, Cold Vapor Atomic Absorption Spectrometer and the Inductively Coupled Plasma. He is responsible for prioritization of metals digestion, wet chemistry analysis and training all personnel conducting these procedures. Mr. Ahrendt has gained over two and a half years experience in analyzing environmental samples for metals.

After graduation, Mr. Ahrendt began working at SIMALABS International conducting Liquid/Liquid and Liquid/Solid extractions for Organic analyses. He was additionally responsible for preparation of TCLP Leachates. Mr. Ahrendt was trained on analysis of all wet chemistry tests and metals digestion. He acquired one year experience in analysis of wet chemistry parameters, preparation of organic and inorganic samples, and TCLP extraction procedures.

Mr. Ahrendt has had the opportunity to work on projects for major manufacturing and industrial accounts. He has additionally worked on projects for government, municipal and consulting engineering accounts.

JOYCE KALETA
Analyst

EDUCATION:

B.S., Biology, Purdue University - North Central, Westville, Indiana, May 1995,
Summa Cum Laude

EXPERIENCE:

Ms. Kaleta's present duties include the supervision of the wet chemistry department. She conducts all spectrophotometric and FIA (Lachet) analysis. She also performs gravimetric and titrimetric analysis, and prepares reagents, standards, and samples.

Ms. Kaleta was responsible for the digestion of samples for metals analysis and TCLP extraction. She was being trained on analysis of wet chemistry tests. She also can assist with organic extractions under the supervision of a trained chemist.

As an undergraduate student at Purdue North Central, Ms. Kaleta assisted in the preparation of precursors for an experimental hydroxyl protecting group for oligoribonucleotide synthesis. This research project was directed by and funded through the Biochemistry department of Purdue University in West Lafayette, Indiana. She was also employed by Purdue North Central as a math tutor.

Ms. Kaleta has gained over two years experience in digestions and TCLP extraction.

MELISSA ZOLODZ
Chemist

EDUCATION:

B.S., Chemistry, Indiana University Northwest, Gary, Indiana, 1996

EXPERIENCE:

Ms. Zolodz currently analyzes extracts for PCB's, which includes cleanup of the extracts and preparation of standards. In addition, Ms. Zolodz analyzes samples for total organic carbon and halides (TOC) , (TOX). She is training on the GC-MS instrument and under Mr. Conjelko's supervision analyzes samples for BTEX.

She is responsible for prepping extracts for analysis of pesticides, semivolatiles, PNA's and TPH. She also has experience in liquid/liquid and liquid/solid extractions.

Ms. Zolodz began working in the wet chemistry department. Her responsibilities included distillations, such as, cyanide and phenols, titrations, BOD and COD, and gravimetric tests.

Ms. Zolodz was previously employed at IUN through an undergraduate research grant. Her project was "Ultrasound in Organic Synthesis: Preparation of Alkynyl Iodonium Salts and Alkynyl Sulfonate Esters." Her responsibilities in this project included preparing, testing, and improving new synthesis methods using ultrasound. She also analyzed the salts and esters using H^1 and C^{13} NMR and IR. She presented her results at the Undergraduate Research Conference at Butler University, Indianapolis, IN in 1995 and 1996, and at IUN in 1996. The results for the Alkynyl Iodonium Salts have been submitted for publication to Tetrahedron Letters. The results for the Alkynyl Sulfonate Esters will be submitted in the future for publication.

BRIAN A. HUDOCK
Chemist

EDUCATION:

B.S., Chemistry, Indiana University Northwest, Gary, Indiana, 1996

EXPERIENCE:

Mr. Hudock is responsible for conducting wet chemistry analysis. He analyzes a variety of samples using, gravimetric and titrimetric tests. These include total, dissolved, and suspended solids, oil and grease, chloride, acidity and alkalinity. Mr. Hudock distills samples for cyanides, sulfides, and phenols. He also performs biological oxygen demand and chemical oxygen demand tests.

Mr. Hudock was hired recently in 1996 following the completion of his college studies.

JOHN C. JEDLICKA
Analyst

EDUCATION:

B.S., Nuclear Engineer, University of Missouri, Rolla, Missouri, 1973

EXPERIENCE:

Mr. Jedlicka's present duties include the digestion of waters, soils, sludges and TCLP extracts for metals analysis by GFAA, Cold Vapor, and ICP. Mr. Jedlicka has also been trained to setup samples for TCLP and ZHE extraction.

As an engineer he worked for Bechtel Power Corp. designing Nuclear power plants as well as a licensing engineer involved in coordinating all facets of Q.A. design reporting to the Nuclear Regulatory Commission.

He later acted as design supervisor for a coal fired, industrial, co-generation power plant for a large international manufacturing company.

John also served as instruction supervisor at Memphis State University, where he supervised the development of a 80 week Basic Nuclear Reactor Operator's course and authored or edited 11 text books on mathematics, physics, chemistry, and nuclear reactor fundamentals.

PHIL KAMBOURIS

Technician

EDUCATION:

B.S., Biology, Purdue University Calumet, Hammond, Indiana, Expected 1997

EXPERIENCE:

Mr. Kambouris is responsible for the extraction of organic compounds. This includes pesticides, PCB's, SVOA's, PNA's, herbicides and TCLP extracts. He is also knowledgeable in the setup of TCLP and ZHE.

Mr. Kambouris was responsible for field sampling and pick-up at numerous facilities throughout the Midwest. He has been trained in the operation of ISCO samplers for composite and storm water sampling.

KEN SMITH

Sample Custodian

EXPERIENCE:

January 1994 to Present. SIMALABS International. - Merrillville, Indiana

Since joining SIMALABS International, Mr. Smith has been responsible for sample custody activities. His responsibilities include sample receipt, log-in, internal COC, disposal, shipping, and receiving. Mr. Smith was trained by company management as to the proper custody procedures, and has acquired over 2 years experience in these procedures.

Carla E. Svetich

Project Manager

EDUCATION:

A.A., Accounting, International Business College, Fort Wayne, Indiana, 1988

EXPERIENCE:

Ms. Svetich, as project manager for SIMALABS International is responsible for the oversight of projects. Ms. Svetich responsibility is tracking samples from the time of receipt to the time of reporting of data. She works together with the laboratory Manager, Sample Custodian, QA/QC officer and Reporting Staff. She verifies all information for the projects and transfer the information to the appropriate parties which includes but not limited to Parameters Requested, Reporting Limits, Data Quality Levels, Holding Times and Due Dates. She also corresponds with all Clients verifying their request.

Also, since 1991 Ms. Svetich has been working with all departments which includes Sample Receiving, Reporting, Organics, Inorganics, Wet Chemistry, Accounting, and Purchasing. She has developed proper SOP's, for each area pertaining to Client Services.

KEVIN A. GARLAND

Network Administrator

EDUCATION:

B.S. Systems Networking, Purdue University, Hammond, Indiana, Expected 1998

A.S. Information Systems & Computer Programming, ~~Purdue University, Hammond, Indiana, 1995~~

Electrical/Computer Engineering courses, Purdue University, West Lafayette, Indiana 1988 -1992

PROFESSIONAL ASSOCIATIONS:

International Association of Electronic and Electrical Engineers (IEEE)

American Society of Computer Professionals (ASCP)

EXPERIENCE:

March 1996 - Present, American Analytical, Inc (A₂I), - Merrillville, Indiana

Mr. Garland, as Network Administrator for A₂I has the responsibilities of maintaining the company's PC network running NeXT's Mach operating system. Duties include administration of all user accounts, computer processes, and peripherals. Additional responsibilities include management of Sybase database system, specialized application development, end-user support, and troubleshooting any software or hardware problems.

1993 - 1996 Indiana Federal Bank for savings - Valparaiso, Indiana

Before coming to A₂I, Mr. Garland was a Unix System Administrator for Indiana Federal Bank. His experience there included the administration of an RS/6000 computer network running IBM's AIX operating system, managing an Informix database system, and developing all specialized database applications. Also, he maintained ATM software, managed a twelve-line voice response unit, generated all departmental reporting, provided end-user support, and troubleshooted any software or hardware problems.

CAROL A. DOYLE
Office Manager

EDUCATION:

B.S. in Business Administration with emphasis in Management and Math (1994) and Paralegal Certification (1987), Robert Morris College, Pittsburgh, Pennsylvania, 1994.

EXPERIENCE:

SIMALABS INTERNATIONAL. Merrillville. IN - December 1996 - Present

Responsibilities include all accounting functions including accounts payable, accounts receivable, general ledger, payroll and purchasing. Preparation of monthly financial statements along with budget analysis and cash management.

STRATEGIC ENERGY LTD. Pittsburgh, PA. - November 1989 - November 1994

Associate Energy Analyst responsible for research, document review, contract analysis, tariff analysis, spreadsheet design and preparation, numerical analysis and preparation of charts, graphs and report text.

MAGEE-WOMENS HOSPITAL. Pittsburgh. PA - May 1994 - August 1994

Purchasing Assistant Intern responsible for assisting three purchasing agents and the purchasing manager in placing orders, price analysis and attended weekly supplier meetings. Educated in different aspects of purchasing and how to handle pricing discrepancies.

DAVID ATTORNEY, ESQUIRE. Pittsburgh. PA - October 1987 - November 1989

Legal Assistant - maintained plaintiff and defense files from inception through completion. Drafted and answered interrogatories, requests for production and other materials necessary for discovery. Drafted pleadings, obtained medical records and prepared pretrial statements.

3.0 QUALITY ASSURANCE OBJECTIVES

3.1 Introduction

SIMALABS International's quality assurance objective is to develop, implement and maintain standard operating procedures and report data that are defensible in a court of law. It is our desire to establish goals to maintain the highest proficiency in obtaining accuracy, precision and completeness of our analyses. These goals allow customers to have total confidence that our data and reports are complete and justifiable.

3.2 Accuracy

Accuracy means the closeness of a value to a reference value. For our purpose, we will use surrogates, spikes, and preparation standards as a tool to monitor accuracy in the laboratory. See tables 3.1, 3.1.1, and 3.1.2 for acceptance limits. The applicable calculations are defined below:

* Percent Recovery of Surrogate:

$$\frac{\text{amount of surrogate found in sample}}{\text{amount of surrogate added to sample}} \times 100$$

* Percent Recovery of Preparation Standards:

$$\frac{\text{amount of standard recovered}}{\text{amount of standard added}} \times 100$$

* Percent of Recovery Spike:

$$\frac{\text{total analyte found} - \text{analyte originally found}}{\text{analyte added}} \times 100$$

3.3 Precision

Precision means the closeness of duplicates and replicates of analyses are done in the laboratory (see Table 3.1 for specified limits).

$$RPD = \frac{(C_1 - C_2) / (C_1 + C_2)}{2} \times 100$$

3.4 Completeness

All samples we receive are analyzed unless otherwise specified from the client. We expect to analyze all samples within QA/QC criteria; however, there will be times when QA/QC cannot be met. Due to this circumstance, we will want to have a completeness of 95%.

Completeness:

$$\frac{\text{total number of approved results}}{\text{total number of samples analyzed}} \times 100$$

3.5 Comparability

Comparability means comparing one sample method to another sample method. SIMALABS International follows methods set forth by the Environmental Protection Agencies (EPA's) 600/4-79-020 and SW-846, 3rd Edition Methods. These methods can be compared to old methods and to future methods set by the agency.

3.6 Representativeness

This is based upon the degrees which on set of data represents the characteristics of the sampling points. This is not applicable to the laboratory setting.

Technique	Method	Matrix	Duplicate Control Limits (+/-)	MS/MSD % Recovery	Preparation Standard Control Limits
ICP	200.7	Aqueous	15%	80 - 120	80 - 120
	6010	Soil/Sludge/Liquid	30%	70 - 130	70 - 130
Cold Vapor AA	245.1/7470	Aqueous	15%	80 - 120	80 - 120
Id Vapor AA	7471	Soil/Sludge/Liquid	30%	70 - 130	70 - 130
Graphite Furnace AA	200 Series/7000 Series	Aqueous	15%	80 - 120	80 - 120
Graphite Furnace AA	7000 Series	Soil/Sludge/Liquid	30%	70 - 130	70 - 130
Acidity	305.1	Aqueous	10%	90 - 110	N/A
Acidity	Land & Lakes	Soil/Sludge/Liquid	30%	70 - 130	N/A
Alkalinity	310.1	Aqueous	10%	90 - 110	N/A
Alkalinity	Land & Lakes	Soil/Sludge/Liquid	30%	70 - 130	N/A
Ammonia as N	350.2	Aqueous	20%	80 - 120	80 - 120
Ammonia as N	350.2 M	Soil/Sludge/Liquid	30%	70 - 130	70 - 130
Ash	160.4	Soil/Sludge/Liquid	20%	N/A	N/A
As	405.1	Aqueous/Sludge	20%	N/A	N/A
Chloride	325.3	Aqueous	10%	90 - 110	N/A
Chloride	9252	Soil/Sludge/Liquid	30%	70 - 130	N/A
Total Chlorine	330.5	Aqueous	15%	85 - 115	N/A
Total Chlorine	330.5 M	Soil/Sludge/Liquid	30%	70 - 130	N/A
COD	410.1	Aqueous	20%	80 - 120	80 - 120
Cyanide, Reactive	7.3.3.2	Aqueous	N/A	N/A	N/A
Cyanide, Reactive	7.3.3.2	Soil/Sludge/Liquid	N/A	N/A	N/A
Cyanide, Total	335.2/9010	Aqueous	15%	80 - 120	80 - 120
Cyanide, Total	9010	Soil/Sludge/Liquid	30%	70 - 130	70 - 130
Flashpoint, closed cup	1010	Aqueous	5 deg. F	N/A	N/A
Flashpoint, open cup	1010	Soil/Sludge/Liquid	5 deg. F	N/A	N/A
Fluoride	340.1	Aqueous	20%	80 - 120	N/A
Fluoride	340.1 M	Soil/Sludge/Liquid	30%	70 - 130	N/A
Hexavalent Chromium	218.4	Aqueous	10%	80 - 120	N/A
Hexavalent Chromium	7106	Soil/Sludge/Liquid	30%	70 - 130	N/A
Nitrate/Nitrite	353.3	Aqueous	20%	80 - 120	N/A
Nitrate/Nitrite	9200	Soil/Sludge/Liquid	30%	70 - 130	N/A
Nitrite	354.1	Aqueous	20%	80 - 120	N/A
Nitrite	354.1 M	Soil/Sludge/Liquid	30%	70 - 130	N/A

TABLE 3.1

(Continued)

Technique	Method	Matrix	Duplicate Control Limits (+/-)	MS/MSD % Recovery	Preparation Standard Control Limits
Oil & Grease	413.1	Aqueous	20%	80 - 120	80 - 120
Oil & Grease	9071	Soil/Sludge/Liquid	40%	60 - 140	60 - 140
Print Filter	9095	Soil/Sludge/Liquid	Pass/Fail	N/A	N/A
Phenolics	420.1/9065	Aqueous	20%	80 - 120	80 - 120
Phenolics	9065	Soil/Sludge/Liquid	30%	70 - 120	70 - 120
Phosphorus, Ortho	365.2	Aqueous	20%	80 - 120	N/A
Phosphorus, Ortho	365.2 M	Soil/Sludge/Liquid	30%	70 - 130	N/A
Phosphorus, Total	365.2	Aqueous	20%	80 - 120	80 - 120
Phosphorus, Total	365.2 M	Soil/Sludge/Liquid	30%	70 - 130	70 - 130
Platinum	150.1/9040	Aqueous	5%	N/A	N/A
Platinum	9045	Soil/Sludge/Liquid	10%	N/A	N/A
Solids, Total	160.3	Aqueous	20%	N/A	N/A
Solids, Total	160.3 M	Soil/Sludge/Liquid	20%	N/A	N/A
Solids, Total Dissolved	160.1	Aqueous/Liquids	20%	N/A	N/A
Solids, Total Suspended	160.2	Aqueous/Liquids	20%	N/A	N/A
Solids, Total Volatile	160.4	Aqueous	20%	N/A	N/A
Solids, Total Volatile	160.4	Soil/Sludge/Liquid	20%	N/A	N/A
Specific Conductance	2510 B	Aqueous	10%	N/A	N/A
Sulfate	375.4	Aqueous	15%	85 - 115	N/A
Sulfate	9038	Soil/Sludge/Liquid	30%	70 - 130	N/A
Sulfide, Reactive	7.3.4.1	Aqueous	N/A	N/A	N/A
Sulfide, Reactive	7.3.4.1	Soil/Sludge/Liquid	N/A	N/A	N/A
Sulfide, Total	376.2/9030	Aqueous	30%	60 - 130	60 - 130
Sulfide, Total	9030	Soil/Sludge/Liquid	50%	50 - 120	50 - 120
Sulfite	377.1	Aqueous	20%	80 - 120	N/A
Sulfite	377.1 M	Soil/Sludge/Liquid	30%	70 - 130	N/A
TN	351.3	Aqueous	20%	80 - 120	80 - 120
TN	351.3 M	Soil/Sludge/Liquid	40%	60 - 140	60 - 140
VOC	624/8240	Aqueous	N/A	-	N/A
VOC	8240	Soil/Sludge/Liquid	N/A	-	N/A
VOC	625/8270	Aqueous	N/A	-	N/A
VOC	8270	Soil/Sludge/Liquid	N/A	-	N/A
WBC/Pesticides	608/S080	Aqueous	N/A	-	N/A

See summary attached Table 3.1.1

See summary attached Table 3.1.2 for organic surrogate spike control limits

TABLE 3.1

(Continued)

Technique	Method	Matrix	Duplicate Control Limits (+/-)	MS/MSD % Recovery	Preparation Standard Control Limits
GB/Pesticides	8080	Soil/Sludge/Liquid	N/A	--	N/A
Herbicides	8150	Aqueous	N/A	--	N/A
Herbicides	8150	Soil/Sludge/Liquid	N/A	--	N/A
H - IR	418.1	Aqueous	20%	80 - 120	80 - 120
H - IR	9071	Soil/Sludge/Liquid	40%	60 - 140	60 - 140
H - GC	8015 M	Aqueous	N/A	80 - 120	N/A
H - GC	8015 M	Soil/Sludge/Liquid	N/A	60 - 140	N/A
IA - HPLC	610/8310	Aqueous	N/A	25 - 120	N/A
IA - HPLC	8310	Soil/Sludge/Liquid	N/A	25 - 120	N/A

See summary attached Table 3.1.1

See summary attached Table 3.1.2 for organic surrogate spike control limits

Organic MS/MSD Control Limits

	Aqueous % Rec. Limit	Aqueous % RPD Limit	Soil/Sludge/Liquid % Rec. Limit	Soil/Sludge/Liquid % RPD Limit
<i>JA Fraction</i>				
1-Dichloroethene	61 - 145	14	59 - 172	22
1,2-Dichloroethene	71 - 120	14	62 - 137	24
Chlorobenzene	75 - 130	13	60 - 133	21
Toluene	76 - 125	13	59 - 139	21
Benzene	76 - 127	11	66 - 142	21
<i>SVOA Fraction</i>				
2,4-Trichlorobenzene	39 - 98	28	38 - 107	23
Acenaphthene	46 - 118	31	31 - 137	19
2,4-Dinitrotoluene	24 - 96	38	28 - 89	47
Di-n-Butylphthalate	11 - 117	40	29 - 135	47
1,2-Dichlorobenzene	26 - 127	31	35 - 142	36
N,N-Dimethyl-2-nitroso-di-n-propylamine	41 - 116	38	41 - 126	38
1,4-Dichlorobenzene	36 - 97	28	28 - 104	27
2,4,6-Trichlorophenol	9 - 103	50	17 - 109	47
Phenol	12 - 89	42	26 - 90	35
2-Chlorophenol	27 - 123	40	25 - 102	50
2-Chloro-3-methylphenol	23 - 97	42	26 - 103	33
4-Nitrophenol	10 - 80	50	11 - 114	50
<i>Pesticide Fraction</i>				
Endosulfan	56 - 123	15	46 - 127	50
Heptachlor	40 - 131	20	35 - 130	31
Dieldrin	40 - 120	22	34 - 132	43
Endrin	52 - 126	18	31 - 134	38
Endrin	56 - 121	21	42 - 139	45
1,1'-DDT	38 - 127	27	23 - 134	50
<i>Herbicide Fraction</i>				
2,4-D	40 - 120	25	30 - 130	50
2,4,5-TP (Silvex)	40 - 120	25	30 - 130	50

Table 3.1.2

Organic Surrogate Recovery Limits

	Aqueous % Recovery Limit	Soil/Sludge/Liquid % Recovery Limit
<i>VOA Fraction</i>		
Toluene-d8	88 - 110	81 - 117
Bromofluorobenzene	86 - 115	74 - 121
1,2-Dichloroethane-D4	76 - 114	70 - 121
<i>SVOA Fraction</i>		
Nitrobenzene-D5	35 - 114	23 - 120
2-Fluorobiphenyl	43 - 116	30 - 116
Terphenyl-D14	33 - 141	18 - 137
Phenol-D5	10 - 94	24 - 113
2-Fluorophenol	21 - 100	25 - 121
2,4,6-Tribromophenol	10 - 123	18 - 122
<i>Pesticide Fraction</i>		
Tetrachloro-M-Xylene(TMX)	50-150	50-150
Decachlorobiphenyl	50-150	50-150
<i>Herbicide Fraction</i>		
Dicamba	50-150	50-150
<i>PNA-HPLC Fraction</i>		
Decafluorobiphenyl	20-140	20-140

4.0 ANALYST/TECHNICIAN TRAINING PROGRAM

4.1 Overview

In today's highly competitive environmental laboratory marketplace, SIMALABS International is incorporating procedures designed to increase and insure the quality of our services. Our product quality is directly proportional to the abilities of our personnel. The capabilities of our analysts are greatly dependent on their training. This program has been designed to ensure that all laboratory analysts are properly trained, and that ongoing verification of their abilities occurs.

4.2 Scope

The SIMALABS International training program involves accounting of previously attained skills, and tracking of skills learned in our facility. To accomplish the initial accounting portion of the program, a form (Example 4.1) has been developed to list those analyses learned in other quality oriented environmental facilities. If possible, a training record from previous employers will be obtained.

Since the background of incoming employees varies, it will be the laboratory managers responsibility to determine the extent of training required. Employees with four year science degrees will fall under our "Analyst" training procedure, while non-degree personnel will be addressed with our "Technician" training program. All records will be updated on an as-needed basis and reviewed by the staff member and laboratory manager during yearly reviews.

4.3 Analyst Training Program

Analyst training will be conducted using a multi-step process, where a checklist (Example 4.2) will be followed to ensure and verify that all necessary aspects of the process are mastered.

When a new test is assigned, the analyst will be instructed to read and understand SIMALABS International's Standard Operating Procedure (SOP). In addition, the analyst will be required to review the applicable methods referenced in the SOP, and any background information deemed significant to achieve full comprehension (e.g. Instrument manuals, EPA CLP SOW's SW-846, etc.). To verify that the proper information was derived, the analyst will conduct a verbal dry run with an experienced analyst.

Upon completion of proper literature study, ~~the new analyst will conduct the test under the~~ supervision of an experienced analyst. Due to the disparity of difficulty in analyses throughout the laboratory, the minimum time for supervision will be test-specific. When supervised training has been completed, the analyst will be released for individual analysis by the supervising analyst.

Verification of the analyst's ability to function self-sufficiently will be determined by analysis of a performance evaluation sample, calibration curve, detection limit study, or other equivalent measure, as prescribed by the laboratory manager.

Due to SIMALABS International stringent QA/QC protocol, and participation in various performance evaluation programs, ongoing analyst capabilities will be monitored. Additionally, it is our intention to implement "double-blind" PE samples analyses, where the Assistant Laboratory Manager and the QC Officer are the only staff members aware that the samples are performance evaluations.

4.4 Technician Training Program

SIMALABS International's intention is to utilize non-degree "Technicians" in sample preparation positions. Training for these positions will be similar to the multi-step process used for analysts. However, testing and monitoring of basic skill will be substantially more stringent. All technician training stages will be tracked utilizing a checklist (Example 4.3).

When a new sample preparation procedure is assigned, the technician will be instructed to read and understand SIMALABS International's Standard Operating Procedure (SOP). In addition, the technician will be required to review the applicable methods referenced in the SOP, and any background information deemed significant to achieve full comprehension (e.g. EPA CLP SOW's, SW-846, etc.). To verify that the proper information was derived, the technician will be verbally quizzed by an experienced analyst.

Upon completion of proper literature study, the new technician will conduct the test under the supervision of an experienced analyst. Due to the nature of preparatory procedures throughout the laboratory, the minimum time for supervision will be test-specific. When the minimum time for supervised training has been reached, the technician will be released for individual work by the supervising analyst.

Verification of the technician's ability to function self-sufficiently will be determined by preparation of a performance evaluation sample, calibration curve, detection limit study, or other equivalent measure, as prescribed by the laboratory manager and QC officer.

Due to the methodologies employed, ongoing verification of the technician's effectiveness occurs. All preparatory processes require sufficient QC samples (e.g. surrogates, spikes, standards, etc.). To monitor the technician's abilities with every preparation batch.

SIMALABS International Previous Experience Records

Name: _____ Date of Hire: _____
Education: _____

previous work experience:

[illegible]

Methods Learned:

[illegible]

SIMALABS International Technician Training Record

Trainee: _____

Date Training Initiated: _____

Method: _____

Trainer: _____

Process	Complete Technician	Complete Date	Approved Trainer	Approved Date
Read & Understand SIMALABS International SOP				
Read Referenced Methods				
Basic Techniques Review				
Calculations Review				
Partial Dry Run				
Observe Technique				
Supervised Analysis				
Released for Independent Work				
Verification of Capabilities *				
Training Report Checklist Completed				

Verification Procedure Utilized:

NOTES: _____

Technician: _____
signature

date

Trainer: _____
signature

date

Lab Manager: _____
signature

date

Example 4.2

SIMALABS International Analyst Training Record

Trainee: _____ Date Training Initiated: _____

Method: _____ Trainer: _____

Process	Completed Analyst	Completed Date	Approved Trainer	Approved Date
Read & Understand SIMALABS International SOP				
Read Referenced Methods				
Verbal Dry Run				
Observe Technique				
Supervised Analysis				
Released for Independent Work				
Verification of Capabilities *				
Training Report Checklist Completed				

Verification Procedure Utilized: _____

Notes: _____

Analyst: _____
signature date

Trainer: _____
signature date

Lab Manager: _____
signature date

5.0 SAMPLE CUSTODY

SIMALABS International has incorporated strict procedures for sample custody. These guidelines were established to maintain the custody of samples in the laboratory, and the legal validity of results generated.

The sample custody SOP outlines the general procedures utilized in sample custody of all samples received. This is to be considered a minimum requirement. Often project specific guidelines are required which supersede these procedures. The attached SOP details sample receipt, login, storage, internal sample transfer, storage and disposal (see Section 5.1).

Table 5.1, Sample Containers and Preservation

Example 5.1, Chain of Custody

Example 5.2, Login/Internal Sample Transfer Page

Example 5.3, Parameter Request sheet

Example 5.4, Internal Sample Transfer COC sheet

Example 5.5, Cooler Inspection Form

Section 5.1

STANDARD OPERATING PROCEDURES FOR SAMPLE CUSTODY

Introduction

This SOP is designed to outline the procedures used to initiate and maintain sample custody for samples received in the laboratory. Procedures have been instituted to insure that proper sample custody has been established upon receipt and that this custody is maintained during the entire analytical process.

Procedure

When a sample cooler is received, sample login is immediately initiated. The cooler is inspected externally to determine if any obvious leakage has occurred. It is additionally checked for any potential hazard warnings. The cooler seals are broken and the chain of custody (COC) (Example 5.1) is removed. A thermometer is placed in the cooler for a period of 15 minutes, and the receipt temperature is recorded. While the cooler temperature is being measured, the COC is reviewed and signed.

The entire contents of the cooler are removed and all samples are placed on the login counter in COC order. All bottles are inspected for problems such as breakage. VOA vials are inspected for headspace, and so noted if any head-space is present. Upon completion of inspection, the COC is checked against the sample bottles received. Any discrepancies or inadequate volumes are notified to the manager immediately.

The sample custodian will login the samples and assign a unique identification number (Example 5.2). This number will be placed on a label and affixed to each jar received for a given sample. The samples are placed in the walk-in cooler (maintained at 4°C), except VOC's which are placed in a segregated refrigerator at 4°C.

The custodian completes a parameter request sheet (Example 5.3) including client information, turnaround time, parameters requested and any pertinent comments regarding sample receipt or analytical requirements.

The internal sample transfer chain of custody (Example 5.4) is completed. Each bottle received is given a separate line on the form. The type of bottle and analyses to be conducted are noted. The sample is initially signed in by the sample custodian. When an analyst requests a sample, the custodian removes the sample container from the cooler and releases it with a signature. Upon completion of the analysis the sample is returned to the sample custodian and signed in.

When a bottle is returned empty, it is noted on the Internal Sample Transfer Chain of Custody and the bottle is disposed. All partially used samples are stored in the cooler for 30 days after the report is sent to the client. After 30 days, the samples are placed in storage for an additional 30 days. At this point, the samples are properly disposed. All storage transfers are noted on the Internal Sample Transfer COC.

Sample Containers and Preservation

Parameter	Matrix	Size and Type of Container	Preservative	Temperature
Metals	Aqueous	500 mL plastic	HNO ₃	Cool to 4 deg. C
Metals	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C
Acidity	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Alkalinity	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Ammonia	Aqueous	1 L amber	H ₂ SO ₄	Cool to 4 deg. C
BOD	Aqueous	1 L amber	—	Cool to 4 deg. C
Chloride	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Total Chlorine	Aqueous	500 mL plastic	—	Cool to 4 deg. C
COD	Aqueous	500 mL plastic	H ₂ SO ₄	Cool to 4 deg. C
Total Cyanide	Aqueous	1 L amber	NaOH	Cool to 4 deg. C
Fluoride	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Hexavalent Chromium	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Nitrate/Nitrite	Aqueous	500 mL plastic	H ₂ SO ₄	Cool to 4 deg. C
Nitrite	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Oil & Grease	Aqueous	1 L amber	H ₂ SO ₄	Cool to 4 deg. C
Phenolics	Aqueous	1 L amber	H ₂ SO ₄	Cool to 4 deg. C
Phosphorous, Ortho	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Phosphorous, Total	Aqueous	500 mL plastic	H ₂ SO ₄	Cool to 4 deg. C
pH	Aqueous	500 mL plastic	—	Cool to 4 deg. C
React./Corros./Ignit.	Soil/Sludge/Liquid	1 L amber	—	Cool to 4 deg. C
Solids Testing	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Solids Testing	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C
Sulfate	Aqueous	500 mL plastic	—	Cool to 4 deg. C
Sulfide	Aqueous	500 mL plastic	Zn Acetate & NaOH	Cool to 4 deg. C
Sulfite	Aqueous	500 mL plastic	—	Cool to 4 deg. C
CLP	Soil/Sludge/Liquid	1 L amber	—	Cool to 4 deg. C
TKN	Aqueous	1 L amber	H ₂ SO ₄	Cool to 4 deg. C
VOC	Aqueous	40 mL vial (2)	HCL	Cool to 4 deg. C
VOC	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C
SVOC	Aqueous	1 L amber (2)	—	Cool to 4 deg. C
VOC	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C
PCB/Pesticides	Aqueous	1 L amber (2)	—	Cool to 4 deg. C
PCB/Pesticides	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C
Herbicides	Aqueous	1 L amber (2)	—	Cool to 4 deg. C
Herbicides	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C
Polynuclear Aromatics	Aqueous	1 L amber (2)	—	Cool to 4 deg. C
Polynuclear Aromatics	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C
TPH - GC	Aqueous	40 mL vial (2)	—	Cool to 4 deg. C
TPH - GC	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C
TPH - IR	Aqueous	1 L amber	—	Cool to 4 deg. C
TPH - IR	Soil/Sludge/Liquid	4 oz. squat	—	Cool to 4 deg. C

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Page of

Location:

Turnaround Time (circle one):

	24 h-hour	48 h-hour	72 h-hour	3-5 Days	7-10 Days
1. <i>Salmonella</i>	100%	100%	100%	100%	100%
2. <i>Shigella</i>	100%	100%	100%	100%	100%
3. <i>Escherichia coli</i>	100%	100%	100%	100%	100%
4. <i>Staphylococcus aureus</i>	100%	100%	100%	100%	100%
5. <i>Pseudomonas aeruginosa</i>	100%	100%	100%	100%	100%
6. <i>Enterobacteriaceae</i>	100%	100%	100%	100%	100%
7. <i>Streptococcus</i>	100%	100%	100%	100%	100%
8. <i>Clostridium</i>	100%	100%	100%	100%	100%
9. <i>Legionella</i>	100%	100%	100%	100%	100%
10. <i>Mycobacterium</i>	100%	100%	100%	100%	100%
11. <i>Candida</i>	100%	100%	100%	100%	100%
12. <i>Aspergillus</i>	100%	100%	100%	100%	100%
13. <i>Penicillium</i>	100%	100%	100%	100%	100%
14. <i>Fusarium</i>	100%	100%	100%	100%	100%
15. <i>Trichoderma</i>	100%	100%	100%	100%	100%
16. <i>Geotrichum</i>	100%	100%	100%	100%	100%
17. <i>Chaetomium</i>	100%	100%	100%	100%	100%
18. <i>Claviceps</i>	100%	100%	100%	100%	100%
19. <i>Alternaria</i>	100%	100%	100%	100%	100%
20. <i>Botrytis</i>	100%	100%	100%	100%	100%
21. <i>Ustilago</i>	100%	100%	100%	100%	100%
22. <i>Sclerotinia</i>	100%	100%	100%	100%	100%
23. <i>Phoma</i>	100%	100%	100%	100%	100%
24. <i>Ascochyta</i>	100%	100%	100%	100%	100%
25. <i>Helminthosporium</i>	100%	100%	100%	100%	100%
26. <i>Verticillium</i>	100%	100%	100%	100%	100%
27. <i>Trichothecium</i>	100%	100%	100%	100%	100%
28. <i>Stilbenes</i>	100%	100%	100%	100%	100%
29. <i>Phenols</i>	100%	100%	100%	100%	100%
30. <i>Alkaloids</i>	100%	100%	100%	100%	100%
31. <i>Terpenes</i>	100%	100%	100%	100%	100%
32. <i>Flavonoids</i>	100%	100%	100%	100%	100%
33. <i>Carotenoids</i>	100%	100%	100%	100%	100%
34. <i>Vitamins</i>	100%	100%	100%	100%	100%
35. <i>Minerals</i>	100%	100%	100%	100%	100%
36. <i>Enzymes</i>	100%	100%	100%	100%	100%
37. <i>Antibiotics</i>	100%	100%	100%	100%	100%
38. <i>Antifungals</i>	100%	100%	100%	100%	100%
39. <i>Antiparasitics</i>	100%	100%	100%	100%	100%
40. <i>Anticancer</i>	100%	100%	100%	100%	100%
41. <i>Antidepressants</i>	100%	100%	100%	100%	100%
42. <i>Antipsychotics</i>	100%	100%	100%	100%	100%
43. <i>Anticonvulsants</i>	100%	100%	100%	100%	100%
44. <i>Anticoagulants</i>	100%	100%	100%	100%	100%
45. <i>Antidiabetics</i>	100%	100%	100%	100%	100%
46. <i>Antihypertensives</i>	100%	100%	100%	100%	100%
47. <i>Anticardiacs</i>	100%	100%	100%	100%	100%
48. <i>Anticancer</i>	100%	100%	100%	100%	100%
49. <i>Antidepressants</i>	100%	100%	100%	100%	100%
50. <i>Antipsychotics</i>	100%	100%	100%	100%	100%
51. <i>Anticonvulsants</i>	100%	100%	100%	100%	100%
52. <i>Anticoagulants</i>	100%	100%	100%	100%	100%
53. <i>Antidiabetics</i>	100%	100%	100%	100%	100%
54. <i>Antihypertensives</i>	100%	100%	100%	100%	100%
55. <i>Anticardiacs</i>	100%	100%	100%	100%	100%
56. <i>Anticancer</i>	100%	100%	100%	100%	100%
57. <i>Antidepressants</i>	100%	100%	100%	100%	100%
58. <i>Antipsychotics</i>	100%	100%	100%		

Contact person to telephone / fax (circle one) results to:

Purchase Order No. (or other billing reference):

Sampled by (PRINT):

Sampler Signature:

Sample #

Date _____

Time

Sample Description

Matrix

Contain-
ers

Laboratory Identification

Comments:

Relinquished by:

Date / Time

Received By:

Date / Time

USE DATE:

SIMALABS International PARAMETER REQUEST SHEET

Paperwork To -

turnaround Time:

Date Rec'd:

Emergency (same day)

72 Hrs

24 Hrs

3 - 5 Days

48 Hrs

7 - 10 Days

Lab ID(s):

QC (Data Pkg. Req'd)

WET CHEM

METALS

ORGANICS

SUBCONTRACTED

Client:

Contact

Address:

Phone No.:

Fax No.:

Job / Proj. #:

P.O. #:

Received By:

Co. Name:

Facility Name:

Sample ID:

Sample Matrix: Aqueous / Soil / Sludge / Oil / Solid / Other:

Physical / Appearance / Gravimetrics

Acid / Base / Water Compatibility

Ash, %

Color

Density (g/cc) / Specific Gravity

Flashpoint - CC (closed cup)

Flashpoint - OC (open cup)

Moisture, % (100 - %TS)

Odor

Paint Filter Test (free liquids, P/F)

Physical Description

Solids, % Settleable

Solids, % Total (TS)

Solids, % Total Dissolved (TDS)

Solids, % Total Suspended (TSS)

Solids, % Total Volatile (TVS)

Turbidity

Demands

BOD - 5 Day

CBOD - 5 Day

Chemical Oxygen Demand (COD)

Dissolved Oxygen (DO)

Winkler

General Chemistry:

Ions, Nutrients, Minerals, etc.

Acidity, as CaCO₃

Alkalinity, as CaCO₃

Chloride (Cl⁻)

Fats, Oil & Grease (FOG)

Fluoride (F⁻)

Hardness, as CaCO₃

Nitrogen, Ammonia (NH₃)

Nitrogen, Nitrate (NO₃⁻)

Nitrogen, Nitrite (NO₂⁻)

Nitrogen, Nitrate + Nitrite

Nitrogen, Total Kjeldahl (TKN)

Nitrogen, Organic (TKN - Ammonia)

pH

Phosphorus, Total

Phosphorous (ortho-Phosphate)

Sulfate (SO₄⁼)

Sulfite (SO₃⁼)

Total Organic Carbon (TOC)

Total Organic Halogen (TOX)

Extractable Org. Halogens (EOX)

Cyanides, Sulfides & Phenolics

Cyanides, Amenable

Cyanides, Reactive

Cyanides, Total

Cyanides, Weak Acid Diss. (WAD)

Phenols, Total

Sulfides, Reactive

Sulfides, Total

Miscellaneous

Asbestos, PLM @

Asbestos, TEM @

Bromide (Br⁻)

Carbonates @

Coliform, Total @

Coliform, Fecal @

E. Coli @

Chlorine, Residual (free)

Chlorine, Total

Dioxins & Jor Furans @

Heating Value (BTU / lb.) @

Pour Point @

Standard Plate Count @

Sulfur

Surfactants (MBAS) @

Viscosity @

Water by Karl Fischer @

Organics

PCB's

Volatile Organics (VOCs)

BTEX

BTEX + MEE

Semi-Volatile Organics (SVOCs)

PNAs

TTO's @

Organo Chlorine Pesticides

Organo Phos / N / S Pesticides @

Chlorophenoxy Acid Herbicides

VOA GC/MS Scan (TICs)

SVOA GC/MS Scan (TICs)

General HC Solvent Scan (GC-FID)

Chlorinated HC Solvent Scan

Alcohol Scan (GC-FID)

2,3,7,8-TCDD Screen (GC/MS SIM)

TPH

IR

GC

TCLP

8 RCRA

13 PP's

Arsenic

Barium

Cadmium

Chromium

Copper

Lead

Mercury

Nickel

Selenium

Silver

Zinc

ICAP Scan

VOC

SVOC

Pesticides

Herbicides

Total Metals

8 RCRA

13 PP's

Aluminum

Antimony

Arsenic

Barium

Beryllium

Boron

Cadmium

Calcium

Chromium, total

Chromium, hexavalent (Cr+6)

Cobalt

Copper

Hardness

Iron

Lead

Lithium

Magnesium

Manganese

Mercury

Molybdenum

Nickel

Potassium

Selenium

Silicon

Silver

Sodium

Strontium

Thallium

Tin

Vanadium

Zinc

ICAP Scan

OTHER

Analyze Immediately!

HT <= 24-hrs!

HT <= 48-hrs!

HT <= 7 days!

7-days until extraction

7-days from TCLP tumble

until prep. extraction

@@ TTO's = SVOCs, VOCs, PNAs, PCBs, Pest's, 2,3,7,8-TCDD (dioxin)

Subcontracted

Comments:

Cooler Inspection Form

Received By: _____

Log-in Date: _____

Client _____

Receipt Date/Time: _____

ent Project No.: _____

Client Contact: _____

Decision Information: _____

Water Temperature: _____

Custody Seals	Present / Absent
Custody Seals	Intact / Broken
Chain - of - Custody	Present / Absent
Sample Condition	Intact / Broken / Leaking

Does COC match samples received YES / NO

Discrepancies: _____

1 moles in cooler.

[illegible]

6.0 CALIBRATION PROCEDURE AND FREQUENCY

6.1 Introduction

All analytical calibration procedures utilized at SIMALABS International have been developed to meet or exceed the requirements specified in SW-846, 3rd edition. These procedures are strictly adhered to at all times. Any variance from these procedures will be approved only by management and QC personnel.

6.2 Acceptance Criteria

Wet Chemistry: The following criteria will be used for evaluation of initial and continuing calibration data. Sample analysis will not proceed unless these criteria are met.

6.2.1 Where applicable initial calibration curves are generated using the procedure outlined in Table 6.1. Valid curves will demonstrate a correlation coefficient between 0.995 and 1.000. Wet Chemistry calibration curves will be valid for 6 months from time of generation, or until continuing calibration results do not recover within acceptable limits. These calibration curves will consist of a minimum of four calibration standards and a blank.

6.2.2 Continuing calibration data for Wet Chemistry analyses will consist of analysis of a blank and a check standard. The blank must demonstrate no contamination above the quantitation limit, and the check standard must show a recovery of 80 - 120%. If the continuing calibration does not recover within these limits, analysis will stop and corrective action will be taken. Blanks and check standards are analyzed every 10 samples.

Metals: The following criteria will be used to evaluate initial and continuing calibration data. Sample analysis will not proceed unless these criteria are met.

6.2.3 *Graphite Furnace and Cold-vapor AA:* Initial calibration of the Graphite Furnace and Cold-vapor AA will consist of analysis of a minimum of 3 standards and a blank. This procedure must be employed immediately preceding all analyses. The correlation coefficient of the curve will fall between 0.995 and 1.000. The calibration curve will be validated by analysis of an ICV and ICB. The ICV must recover between 80 - 120%. Continuing calibration will consist of analysis of a CCV and CCB every 10 samples. The CCV recovery must fall between 80 - 120%, and the CCB must be below the quantitation limit. If the CCB and/or the CCV do not pass this criteria, analysis will cease and corrective action will be employed.

6.2.4 *Inductively Coupled Plasma:* Initial calibration of the ICP will be conducted per manufacturer's specifications. This will include analysis of a blank and standard for all elements of interest. The initial calibration will be verified by analysis of an ICV and ICB. The ICV must recover between 90 - 110%. Additionally, initial calibration of the ICP will consist of quarterly determination of interelement corrective factors and individual compounds linear ranges.

Continuing calibration of the ICP will involve analysis of a CCV and CCB every 10 samples. The CCV must recover within 90 - 110% and the CCB must demonstrate background contamination below the quantitation limit. Additionally, analysis of an Interference Check Sample (ICS) will be performed at the beginning and end of every sequence. All compounds must recover within 20% of their true value.

Organic Analysis: The following criteria will be used to evaluate initial and continuing calibration data. Sample analysis will not proceed unless these criteria are met.

- 6.2.5 *VOC and SVOC:* Initial calibration will consist of analysis of a tune check followed by a 5-point curve for all compounds. The curve validity will be determined by comparison of the CCC and SPCC compounds specified in SW-846. All these compounds must pass their criteria for analysis to begin. See Table 6.2 for the CCC and SPCC compounds and their acceptable limits.

Continuing calibration for VOA and SVOA analysis will involve analysis of a tune check followed by a mid-point standard containing all analytes of concern. The continuing calibration will be evaluated using the CCC and SPCC compounds against the limits specified in Table 6.3.

- 6.2.6 *PCB/Pesticides/Herbicides:* Initial calibration for Pesticides or Herbicides will consist of a 5-point calibration curve. Preceding the Pesticide curve an Endrin/DDT breakdown will be conducted. The Endrin/DDT breakdown will be acceptable if neither compound breaks down greater than 20% and the sum of both breakdowns does not exceed 30%. The 5-point curve must have all compound %RSD; $\leq 15\%$.

Continuing calibration for Pesticides or Herbicides will involve analysis of a mid-point standard containing all compounds. The % Difference of all compounds from the initial calibration must be $\leq 20\%$. Preceding analysis of a continuing calibration standard, an Endrin/DDT breakdown will be analyzed to meet with the criteria specified above.

Initial calibration for PCB's will utilize a minimum 3-point calibration curve for Aroclor 1260. Normal calibration will utilize Aroclor 1260 unless other Aroclor's are known to be present. All curve % RSD's will be $\leq 20\%$.

Continuing calibration for PCB's will involve analysis of a mid-point standard for Aroclor 1260 unless other Aroclor's are known to be present. The % Difference from the curve must be $\leq 15\%$. If upon analysis it is determined that other Aroclors are present, a continuing calibration will be analyzed for that Aroclor immediately following the sample set, within 12 hours of sample analysis time.

Initial calibration for TPH will consist of a 5-point calibration curve. The 5-point curve must have a % RSD $\leq 25\%$. TPH curves are routinely analyzed for Gasoline, Diesel #2 and Motor Oil, however curves for other fuels are analyzed where applicable.

Continuing calibration for TPH will involve analysis of a mid-point standard of the fuel of concern. The % difference from the curve must be $\leq 20\%$.

- 6.2.7 *HPLC - PNA's:* Initial calibration for PNA's will consist of analysis of a 5-point curve for both UV and Fluorescence detectors. All compounds % RSD's must be $\leq 30\%$.

Continuing calibration for PNA's will involve analysis of a mid-point standard for both UV and Fluorescence ranges. If higher reporting limits are desired, analysis of only a UV continuing calibration will occur. All compound % differences must be $\leq 30\%$ for analysis to proceed.

6.3 Accuracy and Traceability of Calibration Standards

Accuracy and traceability of calibration standards are handled in the following manner:

6.3.1 Organics

All calibration standard lots are checked against certified standards. These certified standards are accompanied by data packages certifying their accuracy. Preparation of the calibration standards are documented in the following fashion:

- Standard name and lot #
- Date prepared and preparation analyst
- Stock standard name, supplier, lot # and concentration
- Date of stock standard receipt, and expiration
- Amount of stock standard used
- Amount of solvent used, and solvent lot #
- Final volume of mixture
- Final concentration of standard

6.3.2 Metals

The stock standards used for preparation of the initial calibration standards are of a different lot or supplier than those used for preparation of the ICV's and CCV's. Preparation of calibration standards and check standards are documented as follows:

- Standard name and lot #
- Date prepared and preparation analyst
- Stock standard name, supplier, lot # and concentration
- Date of stock standard receipt, and expiration
- Amount of stock standard used
- Amount of acid used and lot #
- Final volume of mixture
- Final concentration of standard

6.3.3 Wet Chemistry

Where possible, all calibration standards prepared or purchased are checked against certified standards to check their accuracy. Preparation of standards are documented as follows:

- Standard name and lot #
- Date prepared and preparation analyst
- Stock standard name, supplier, lot # and concentration
- Date of stock standard receipt, and expiration
- Amount of stock standard used
- Amount of dilution reagents used and lot #
- Final volume of mixture
- Final concentration of standard

Calibration Procedures and Frequency

Parameter	Initial Calibration	Continuing Calibration	Comments
Inducting coupled Plasma	Blank, Standard, ICV, ICB	CCV of different stock, CCB every 10 samples, ICS per batch	Quarterly linear ranges Quarterly interelement checks
Gold Vapor AA	4 point + blank minimum	CCV of different stock, CCB every 10 samples	Initial calibration daily
Graphite Furnace AA	4 point + blank minimum	CCV of different stock, CCB every 10 samples	Initial calibration daily
Acidity	N/A	Blank, titrant & check	All titrations in duplicate
Alkalinity	N/A	Blank, titrant & check	All titrations in duplicate
Ammonia as N	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Balance	Daily balance calibration	Blank	Check dessicant yearly balance & weights certification
COD	Winkler titration weekly	Seed, blank, standard	N/A
Chloride	N/A	Blank, check standard	All titrations in duplicate
Total Chlorine	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
COD	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Cyanide, Reactive	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Cyanide, Total	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Flashpoint, open and closed cup	Certified thermometer check	Blank, standard every 10 samples	N/A
Fluoride	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Hexavalent Chromium	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months

Calibration Procedures and Frequency

Parameter	Initial Calibration	Continuing Calibration	Comments
Nitrate/Nitrite	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Nitrite	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Oil & Grease	Daily balance calibration	Blank, standard	
Paint Filter	N/A	N/A	
phenolics	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
phosphorus, Ortho	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
phosphorus, Total	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
pH	Buffer 4.0, 7.0, 10.0 calibration	Daily buffer 7.0 check	New buffer each use
Solids, Total	Daily balance calibration	Blank	Check dessicant yearly balance & weights cert.
Solids, Total Dissolved	Daily balance calibration	Blank	Check dessicant yearly balance & weights cert.
Solids, Total Suspended	Daily balance calibration	Blank	Check dessicant yearly balance & weights cert.
Solids, Total Volatile	Daily balance calibration	Blank	Check dessicant yearly balance & weights cert.
Specific Conductance	Cell constant determination every 6 months	Blank + .01 M KCl Standard (in duplicates)	N/A
Sulfate	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Sulfide, Reactive	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Sulfide, Total	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
Sulfite	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months

Calibration Procedures and Frequency

Parameter	Initial Calibration	Continuing Calibration	Comments
TKN	4 point + blank minimum	Blank, CCV every 10 samples	New curve every 6 months
VOC	Tune check 5 point curve	Tune check & 50 ppb standard every 12 hour sequence	QC check standard with new standard lot
SVOC	Tune check 5 point curve	Tune check & 50 ppb standard every 12 hour sequence	QC check standard with new standard lot
- CB/Pesticides	5 point curve	Midpoint standard every 12 hour sequence	QC check standard with new standard lot
erbicides	5 point curve	Midpoint standard every 12 hour sequence	QC check standard with new standard lot
PH - IR	5 point curve	Midpoint standard every 10 samples	N/A
PH - GC	5 point curve	Midpoint standard every 12 hour sequence	QC check standard with new standard lot
NA - HPLC	5 point curve	Midpoint standard every 12 hour sequence	QC check standard with new standard lot

Table 6.2
Organic Initial Calibration
CCC \ SPCC Limits

VOA Fraction Calibration Check Compounds(CCC)
Maximum %RSD for CCC is 30 %

Vinyl Chloride	1,2-Dichloropropane
1,1-Dichloroethene	Toluene
Chloroform	Ethylbenzene

VOA Fraction System Performance Check Compounds(SPCC)
Minimum mean RF for SPCC is 0.300, 0.250 for Bromoform

Chloromethane	1,1,2,2-Tetrachloroethane
1,1-Dichloroethane	Chlorobenzene
Bromoform	

SVOA Fraction Calibration Check Compounds(CCC)
Maximum %RSD for CCC is 30 %

Phenol	Acenaphthene
1,4-Dichlorobenzene	N-Nitrosodiphenylamine
2,4-Dimethylphenol	Pentachlorophenol
2,4-Dichlorophenol	Fluoranthene
Hexachlorobutadiene	Di-n-Octyl Phthalate
4-Chloro-3-Methylphenol	Benzo(a)Pyrene
2,4,6-Trichlorophenol	

SVOA Fraction System Performance Check Compounds(SPCC)
Minimum mean RF for SPCC is 0.050

N-Nitroso-Di-n-Propylamine
Hexachlorocyclopentadiene
2,4-Dinitrophenol
4-Nitrophenol

Table 6.3
Organic Continuing Calibration
CCC \ SPCC Limits

VOA Fraction Calibration Check Compounds(CCC)
Maximum %RSD for CCC is 25 %

Vinyl Chloride	1,2-Dichloropropane
1,1-Dichloroethene	Toluene
Chloroform	Ethylbenzene

VOA Fraction System Performance Check Compounds(SPCC)
Minimum mean RF for SPCC is 0.300, 0.250 for Bromoform

Chloromethane	1,1,2,2-Tetrachloroethane
1,1-Dichloroethane	Chlorobenzene
Bromoform	

SVOA Fraction Calibration Check Compounds(CCC)
Maximum %RSD for CCC is 25 %

Phenol	Acenaphthene
1,4-Dichlorobenzene	N-Nitrosodiphenylamine
2,4-Dimethylphenol	Pentachlorophenol
2,4-Dichlorophenol	Fluoranthene
Hexachlorobutadiene	Di-n-Octyl Phthalate
4-Chloro-3-Methylphenol	Benzo(a)Pyrene
2,4,6-Trichlorophenol	

SVOA Fraction System Performance Check Compounds(SPCC)
Minimum mean RF for SPCC is 0.050

N-Nitroso-Di-n-Propylamine
Hexachlorocyclopentadiene
2,4-Dinitrophenol
4-Nitrophenol

7.0 ANALYTICAL METHODS

SIMALABS International follows analytical procedures taken from methods listed in the below mentioned manuals. Table 7.1 lists all methods to be employed for this project.

All analyses in the laboratory have been developed to meet with guidelines established in the referenced methods and this QAPP. No deviation from these procedures will occur without notification to and approval of the Quality Assurance Officer.

SIMALABS International has established specific SOP's for all tests analyzed in this project. These SOP's reflect exact procedures used when analyzing samples in the laboratory. These procedures are maintained by the Quality Assurance Officer and routinely updated when changes are warranted. Copies of these SOP's can be furnished upon request.

7.1 Methods:

1. Methods for Chemical Analysis of Water and Waste, EPA No. 600-79-020, March, 1979 (revised March, 1983)
2. "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November, 1986 and any subsequent updates, supplements or amendments
3. Standard Methods for the Examination of Water and Waste Water, 17th Edition, 1989

7.1.1 Wet Chemistry

Analyte	Aqueous Method	Soil/Sludge Liquid Method	Aqueous PQL* (mg/L)	Soil/Sludge Liquid PQL* (mg/Kg)		
					P	A
Acidity	305.1	Land & Lakes	10	1.0 %		
Alkalinity	310.1	Land & Lakes	10	1.0 %		
Ammonia as N	350.2	350.2 M	0.50	50		
Ash	N/A	160.4	N/A	0.1 %		
BOD	405.1	N/A	2.0	N/A		
Chloride	325.3	9252	1.0	100		
Total Chlorine	330.5	330.5 M	0.05	5.0		
COD	410.1	N/A	10	N/A		
Cyanide, Reactive	7.3.3.2	7.3.3.2	10	10		
Cyanide, Total	335.2/9010	9010	0.05	5.0	X	X
Flashpoint, Closed-cup	1010	N/A	+/- 2 deg F	N/A		
Flashpoint, Open-cup	N/A	1010	N/A	+/- 2 deg F		
Fluoride	340.1	340.1 M	0.50	50		
Hexavalent Chromium	218.4	7196	0.05	5.0		
Nitrate/Nitrite	353.3	9200	0.50	50		
Nitrite	354.1	354.1 M	0.05	5.0		
Oil & Grease	413.1	9071	1.0	100		
Paint Filter	9095	9095	Pass/Fail	Pass/Fail		
Phenolics	420.1/9065	9065	0.05	5.0	X	
Phosphorous, Ortho	365.2	365.2 M	0.05	5.0		
Phosphorous, Total	365.2	365.2 M	0.50	50		
pH	150.1/9040	9045	+/- 0.02 S.U.	+/- 0.02 S.U.		
Solids, Total	160.3	160.3 M	10	0.1 %		
Solids, Total Dissolved	160.1	N/A	10	N/A		
Solids, Total Suspended	160.2	N/A	10	N/A		
Solids, Total Volatile	160.4	N/A	10	N/A		
Specific Conductance	2510 B	N/A	10 umhos/cm	N/A		
Sulfate	375.4	9038	10	1000		
Sulfide, Reactive	7.3.4.1	7.3.4.1	5.0	5.0		
Sulfide, Total	376.2/9030	9030	0.05	5.0		X
Sulfite	377.1	377.1 M	1.0	100		
TKN	351.3	351.3 M	0.50	50		

PQL = Practical Quantitation Limit; P = Priority Pollutants, A = Appendix IX
 These limits are matrix dependent, and may not be achievable on all samples

Table 7.1 Analytical method (cont.)

7.1.2 Metals

Analyte	Aqueous Method	Soil/Sludge Liquid Method	Aqueous PQL* (mg/L)	Soil/Sludge Liquid PQL* (mg/Kg)				
					R	T	P	A
Aluminum	200.7/6010	6010	0.20	20				
Antimony	200.7/6010	6010	0.20	20				X
Antimony	202.2/7041	7041	0.05	5.0			X	
Arsenic	206.2/7060	7060	0.01	1.0	X		X	X
Arsenic	200.7/6010	6010	0.20	20		X		
Barium	200.7/6010	6010	0.01	1.0	X	X		X
Beryllium	200.7/6010	6010	0.003	0.30			X	X
Boron	200.7/6010	6010	0.10	10				
Cadmium	200.7/6010	6010	0.01	1.0	X	X	X	X
Cadmium	213.2/7131	7131	0.003	0.30				
Chromium	200.7/6010	6010	0.01	1.0	X	X	X	X
Chromium	218.2/7191	7191	0.005	0.50				
Cobalt	200.7/6010	6010	0.01	1.0				X
Copper	200.7/6010	6010	0.01	1.0			X	X
Copper	220.2/7211	7211	0.005	0.50				
Copper	200.7/6010	6010	0.05	5.0				
Lead	200.7/6010	6010	0.05	5.0	X	X	X	X
Lead	239.2/7421	7421	0.005	0.50				
Lithium	200.7/6010	6010	0.02	2.0				
Magnesium	200.7/6010	6010	0.20	20				
Manganese	200.7/6010	6010	0.01	1.0				
Mercury	7470	7471	0.001	0.10	X	X	X	X
Molybdenum	200.7/6010	6010	0.01	1.0				
Nickel	200.7/6010	6010	0.01	1.0			X	X
Potassium	200.7/6010	6010	2.0	200				
Selenium	270.2/7740	7740	0.01	1.0	X		X	X
Selenium	200.7/6010	6010	0.20	20		X		
Silicon	200.7/6010	6010	0.20	20				
Silver	200.7/6010	6010	0.01	1.0	X	X	X	X
Sodium	200.7/6010	6010	1.0	100				
Strontium	200.7/6010	6010	0.05	5.0				
Thallium	200.7/6010	6010	0.20	20				X
Thallium	279.2/7841	7841	0.005	0.50			X	
Tin	200.7/6010	6010	0.02	2.0				X
Vanadium	200.7/6010	6010	0.01	1.0				X
Zinc	200.7/6010	6010	0.01	1.0			X	X

PQL = Practical Quantitation Limit;

these limits are matrix dependent, and may not be achievable on all samples

R = 8 RCRA, T = TCLP 8 RCRA, P = Priority Pollutants, A = Appendix IX

Table 7.1 Analytical Method (cont.)

7.1.3 Organics

Analyte	Aqueous Method	Soil/Sludge/Liquid Method	Aqueous PQL* (ug/L)	Soil/Sludge/Liquid PQL* (ug/Kg)				
					R	T	P	A
Acenaphthene	625/8270	8270	10	330	X		X	X
Acenaphthylene	625/8270	8270	10	330	X		X	X
Acetone	8240	8240	10	10	X			X
Acetophenone	8270	8270	10	330	X			X
2-Acetylaminofluorene	8270	8270	10	330				X
Acrolein	8240	8240	100	100	X			X
Acrylonitrile	8240	8240	100	100	X			X
Adrin	608/8080	8080	1.0	33	X		X	X
Alkyl Chloride	8240	8240	100	100				X
4-Aminobiphenyl	8270	8270	10	330	X			X
Aniline	8270	8270	10	330	X			X
Anthracene	625/8270	8270	10	330	X		X	X
Ascarbate	8270	8270	10	330				X
Aroclor-1016	608/8080	8080	1.0	33	X		X	X
Aroclor-1221	608/8080	8080	1.0	33	X		X	X
Aroclor-1232	608/8080	8080	1.0	33	X		X	X
Aroclor-1242	608/8080	8080	1.0	33	X		X	X
Aroclor-1248	608/8080	8080	1.0	33	X		X	X
Aroclor-1254	608/8080	8080	1.0	33	X		X	X
Aroclor-1260	608/8080	8080	1.0	33	X		X	X
Benzene	624/8240	8240	5	5	X	X	X	X
Benzidine	625/8270	8270	50	1600	X		X	
Benzo(a)anthracene	625/8270	8270	10	330	X		X	X
Benzo(b)fluoranthene	625/8270	8270	10	330	X		X	X
Benzo(k)fluoranthene	625/8270	8270	10	330	X		X	X
Benzo(ghi)perylene	625/8270	8270	10	330	X		X	X
Benzo(a)pyrene	625/8270	8270	10	330	X		X	X
Benzoic Acid	8270	8270	50	1600	X			
Benzyl Alcohol	8270	8270	50	1600	X			X
Beta-BHC	608/8080	8080	1.0	33	X		X	X
Beta-BHC	608/8080	8080	1.0	33	X		X	X
Beta-BHC	608/8080	8080	1.0	33	X		X	X
Gamma-BHC (Lindane)	608/8080	8080	1.0	33	X	X	X	X
Bis(2-chloroethoxy)methane	625/8270	8270	20	660	X		X	X
Bis(2-chloroethyl)ether	625/8270	8270	10	330	X		X	X
Bis(2-chloroisopropyl)ether	625/8270	8270	10	330	X		X	X
Bis(2-ethylhexyl)phthalate	625/8270	8270	10	330	X		X	X
Bromodichloromethane	624/8240	8240	5	5	X		X	X
Bromoform	624/8240	8240	5	5	X		X	X

PQL = Practical Quantitation Limit;

these limits are matrix dependent, and may not be achievable on all samples

R = RCRA Hazardous Substances, T = TCLP, P = Priority Pollutants, A = Appendix IX Organics

1.1.3 Organics

Analyte	Aqueous Method	Soil/Sludge Liquid Method	Aqueous PQL* (ug/L)	Soil/Sludge Liquid PQL* (ug/Kg)				
					R	T	P	A
Bromomethane	624/8240	8240	10	10	X		X	X
Bromophenyl Phenyl Ether	625/8270	8270	10	330	X		X	X
Butylbenzylphthalate	625/8270	8270	10	330	X		X	X
Carbon Disulfide	8240	8240	5	5	X			X
Carbon Tetrachloride	624/8240	8240	5	5	X	X	X	X
Chlordane	608/8080	8080	10	330	X	X	X	X
Chloroaniline	8270	8270	20	660	X			X
Chlorobenzene	624/8240	8240	5	5	X	X	X	X
Chlorobenzilate	8270	8270	10	330				X
Chloroprene	8240	8240	5	5				X
p-Chloro-m-cresol	625/8270	8270	20	660	X		X	X
Dibromodibromomethane	624/8240	8240	5	5	X		X	X
1,2-Dichloroethylvinylether	624/8240	8240	10	10	X		X	
1,1-Dichloroethane	624/8240	8240	10	10	X		X	X
Dichloroform	624/8240	8240	5	5	X	X	X	X
Dichloromethane	624/8240	8240	10	10	X		X	X
Dichloronaphthalene	625/8270	8270	10	330	X		X	X
Dichlorophenol	625/8270	8270	10	330	X		X	X
1,4-Dichlorophenyl Phenyl Ether	625/8270	8270	10	330	X		X	X
Dibenzene	625/8270	8270	10	330	X		X	X
m-Cresol	8270	8270	10	330		X		X
p-Cresol	8270	8270	10	330	X	X		X
m-Cresol	8270	8270	10	330	X	X		X
2,4-D	8150	8150	10	330	X	X		X
1,1'-DDD	608/8080	8080	1.0	33	X		X	X
1,1'-DDE	608/8080	8080	1.0	33	X		X	X
1,1'-DDT	608/8080	8080	1.0	33			X	X
Dieldrin	8270	8270	10	330	X			X
Dibenzo(a,h)anthracene	625/8270	8270	10	330	X		X	X
Dibenzofuran	8270	8270	10	330	X			X
1,2-Dibromo-3-chloropropane	8240	8240	5	5				X
1,2-Dibromoethane	8240	8240	5	5				X
Dibromomethane	8240	8240	5	5	X			X
Di-n-butylphthalate	625/8270	8270	10	330	X		X	X
1,2-Dichlorobenzene	625/8270	8270	10	330	X		X	X
1,3-Dichlorobenzene	625/8270	8270	10	330	X		X	X
p-Dichlorobenzene	625/8270	8270	10	330	X	X	X	X
1,3'-Dichlorobenzidine	625/8270	8270	20	660	X		X	X
trans-1,4-Dichloro-2-butene	8240	8240	5	5	X			X

*PQL = Practical Quantitation Limit.

These limits are matrix dependent, and may not be achievable on all samples.

R = RCRA Hazardous Substances, T = TCLP, P = Priority Pollutants, A = Appendix IX Organics

7.1.3 Organics

Analyte	Aqueous Method	Soil/Sludge Liquid Method	Aqueous PQL* (ug/L)	Soil/Sludge Liquid PQL* (ug/Kg)				
					R	T	P	A
Trichlorodifluoromethane	8240	8240	5	5	X			X
1,1-Dichloroethane	624/8240	8240	5	5	X		X	X
1,2-Dichloroethane	624/8240	8240	5	5	X	X	X	X
1,1-Dichloroethylene	624/8240	8240	5	5	X	X	X	X
trans-1,2-Dichloroethylene	624/8240	8240	5	5	X		X	X
Dichloromethane	624/8240	8240	5	5	X		X	X
4-Dichlorophenol	625/8270	8270	10	330	X		X	X
2,6-Dichlorophenol	8270	8270	10	330				X
1,2-Dichloropropane	624/8240	8240	5	5	X		X	X
cis-1,3-Dichloropropene	624/8240	8240	5	5	X		X	X
trans-1,3-Dichloropropene	624/8240	8240	5	5	X		X	X
Dieldrin	608/8080	8080	1.0	33	X		X	X
Diethylphthalate	8270	8270	10	330	X			X
1,1-O-Diethyl-O-2-pyrazinyl phosphorothioate	8270	8270	10	330				X
Dimethoate	8270	8270	10	330				X
Dimethylamionbenzene	8270	8270	10	330	X			X
1,2-Dimethylbenz(a)anthracene	8270	8270	10	330	X			X
2,3'-Dimethylbenzidine	8270	8270	10	330				X
alpha, alpha-Dimethyl-phenethylamine	8270	8270	10	330	X			X
1,4-Dimethylphenol	625/8270	8270	10	330	X		X	X
Dimethylphthalate	625/8270	8270	10	330	X		X	X
m-Dinitrobenzene	8270	8270	10	330				X
2,6-Dinitro-o-cresol	625/8270	8270	50	1600	X		X	X
2,4-Dinitrophenol	625/8270	8270	50	1600	X		X	X
2,4-Dinitrotoluene	8270	8270	10	330	X	X		X
2,6-Dinitrotoluene	625/8270	8270	10	330	X		X	X
Di-n-octylphthalate	625/8270	8270	10	330	X		X	X
1,4-Dioxane	8240	8240	150	150				X
Diphenylamine	8270	8270	10	330	X			X
2,2-Diphenylhydrazine	8270	8270	10	330	X			
Di-n-propylnitrosamine	625/8270	8270	10	330	X		X	X
Disulfoton	8270	8270	10	330				X
Endosulfan I	608/8080	8080	1.0	33	X		X	X
Endosulfan II	608/8080	8080	1.0	33	X		X	X
Endosulfan Sulfate	608/8080	8080	1.0	33	X		X	X
Endrin	608/8080	8080	1.0	33	X	X	X	X
Endrin Aldehyde	608/8080	8080	1.0	33	X		X	X

PQL = Practical Quantitation Limit

These limits are matrix dependent, and may not be achievable on all samples

R = RCRA Hazardous Substances, T = TCLP, P = Priority Pollutants, A = Appendix IX Organics

1.3 Organics

Analyte	Aqueous Method	Soil/Sludge Liquid Method	Aqueous PQL* (ug/L)	Soil/Sludge Liquid PQL* (ug/Kg)	R	T	P	A
Ethyl Benzene	624/8240	8240	5	5	X		X	X
Ethyl Methacrylate	8240	8240	5	5	X			X
Ethyl Methanesulfonate	8270	8270	10	330				X
Fluoranthene	8270	8270	10	330				X
Fluorene	625/8270	8270	10	330	X		X	X
Heptachlor	608/8080	8080	1.0	33	X	X	X	X
Heptachlor Epoxide	608/8080	8080	1.0	33	X	X	X	X
Hexachlorobenzene	625/8270	8270	10	330	X	X	X	X
Hexachlorobutadiene	625/8270	8270	10	330	X	X	X	X
Hexachlorocyclopentadiene	625/8270	8270	10	330	X		X	X
Hexachloroethane	625/8270	8270	10	330	X	X	X	X
Hexachlorophene	8270	8270	10	330				X
Hexachloropropene	8270	8270	10	330				X
Hexanone	8240	8240	10	10	X			X
Indeno(1,2,3-cd)pyrene	625/8270	8270	10	330	X		X	X
Iodomethane	8240	8240	50	50	X			X
Isobutyl Alcohol	8240	8240	50	50				X
Isodrin	8270	8270	10	330				X
Isophorone	625/8270	8270	10	330	X		X	X
Isosafrole	8270	8270	10	330				X
Isoprene	8270	8270	10	330				X
Methacrylonitrile	8240	8240	5	5				X
Methacrylonitrile	8270	8270	10	330				X
Methoxychlor	8080	8080	1.0	33	X	X		X
Methylcholanthrene	8270	8270	10	330				X
Methyl Ethyl Ketone	8240	8240	10	10	X	X		X
Methyl Methacrylate	8240	8240	5	5				X
Methyl Methanesulfonate	8270	8270	10	330				X
Methylnaphthalene	8270	8270	10	330	X			X
Methyl Parathion	8270	8270	10	330				X
4-Methyl-2-pentanone	8240	8240	10	10	X			X
Naphthalene	625/8270	8270	10	330	X		X	X
4-Naphthoquinone	8270	8270	10	330				X
Naphthylamine	8270	8270	10	330				X
Naphthylamine	8270	8270	10	330				X
m-Nitroaniline	8270	8270	50	1600	X			X
m-Nitroaniline	8270	8270	50	1600	X			X
m-Nitroaniline	8270	8270	50	1600	X			X

*QL = Practical Quantitation Limit

These limits are matrix dependent, and may not be achievable on all samples

X = RCRA Hazardous Substances, T = TCLP, P = Priority Pollutants, A = Appendix IX Organics

7.1.3 Organics

Analyte	Aqueous Method	Soil/Sludge/ Liquid Method	Aqueous PQL* (ug/L)	Soil/Sludge/ Liquid PQL* (ug/Kg)	R T P A			
					R	T	P	A
1,4-Dinitrobenzene	625/8270	8270	10	330	X	X	X	X
2,4-Dinitrophenol	625/8270	8270	10	330	X		X	X
4-Nitrophenol	625/8270	8270	50	1600	X		X	X
2-Nitroquinoline-1-oxide	8270	8270	10	330				X
N-Nitrosodi-n-butylamine	8270	8270	10	330				X
N-Nitrosodiethylamine	8270	8270	10	330	X			X
N-Nitrosodimethylamine	625/8270	8270	10	330	X		X	X
N-Nitrosodiphenylamine	625/8270	8270	10	330	X		X	X
N-Nitrosomethylethylamine	8270	8270	10	330				X
N-Nitrosomorpholine	8270	8270	10	330				X
N-Nitrosopiperidine	8270	8270	10	330	X			X
N-Nitrosopyrrolidine	8270	8270	10	330				X
5-Nitro-2-toluidine	8270	8270	10	330				X
Parathion	8270	8270	10	330				X
Pentachlorobenzene	8270	8270	10	330	X			X
Pentachloroethane	8240	8240	5	5				X
Pentachloronitrobenzene	8270	8270	10	330	X			X
Pentachlorophenol	625/8270	8270	10	330	X	X	X	X
Phenacetin	8270	8270	10	330	X			X
Phenanthrene	625/8270	8270	10	330	X		X	X
Phenol	625/8270	8270	10	330	X		X	X
3-Phenylenediamine	8270	8270	10	330				X
Phorate	8270	8270	10	330				X
2-Picoline	8270	8270	10	330	X			X
Pronamide	8270	8270	10	330	X			X
Pyrene	625/8270	8270	10	330	X		X	X
Pyridine	8270	8270	10	330		X		X
Saflrole	8270	8270	10	330				X
Styrene	8240	8240	5	5	X			X
1,2,4,5-Tetrachlorobenzene	8270	8270	10	330	X			X
1,1,1,2-Tetrachloroethane	8240	8240	5	5				X
1,1,1,2-Tetrachloroethane	624/8240	8240	5	5	X		X	X
1,1,2,2-Tetrachloroethane	624/8240	8240	5	5	X	X	X	X
1,2,3,4-Tetrachloroethylene	8270	8270	10	330	X			X
2,3,4,5-Tetrachlorophenol	8270	8270	10	330				X
Tetraethyldithiopyrophosphate	8270	8270	10	330				X
Toluene	624/8240	8240	5	5	X		X	X
Toluenediamine	8270	8270	50	1600	X			
2-Toluidene	8270	8270	10	330				X
Toxachene	608/8080	8080	10	330	X	X	X	X

PQL = Practical Quantitation Limit.

These limits are matrix dependent, and may not be achievable on all samples.

R = RCRA Hazardous Substances, T = TCLP, P = Priority Pollutants, A = Appendix IX Organics

7.1.3 Organics

Analyte	Aqueous Method	Soil/Sludge Liquid Method	Aqueous PQL* (ug/L)	Soil/Sludge Liquid PQL* (ug/Kg)				
					R	T	P	A
4,5-TP (Silvex)	8150	8150	10	330	X	X		X
2,4-Trichlorobenzene	625/8270	8270	10	330	X		X	X
1,1,1-Trichloroethane	624/8240	8240	5	5	X		X	X
1,2-Trichloroethane	624/8240	8240	5	5	X		X	X
Trichloroethylene	624/8240	8240	5	5	X		X	X
Trichlorofluoromethane	624/8240	8240	5	5	X		X	X
4,5-Trichlorophenol	8270	8270	10	330	X	X		X
2,4,6-Trichlorophenol	625/8270	8270	10	330	X	X	X	X
2,3-Trichloropropane	8240	8240	5	5	X			X
J,O,O-triethylphosphorothioate	8270	8270	10	330				X
sym-Trinitrobenzene	8270	8270	10	330				X
Vinyl Acetate	8240	8240	5	5	X			X
Vinyl Chloride	624/8240	8240	10	10	X	X	X	X
Total Xylenes	8240	8240	5	5	X			X

* PQL = Practical Quantitation Limit;

These limits are matrix dependent, and may not be achievable on all samples

R = RCRA Hazardous Substances, T = TCLP, P = Priority Pollutants, A = Appendix IX Organics

8.0 DATA REDUCTION, VALIDATION AND REPORTING

8.1 Introduction

This section is dedicated to the processes employed by SIMALABS International to insure that raw results are accurately transformed into final reports. Additionally, the procedures used for data validation to insure adherence to this QAPP are discussed.

8.2 Data Reduction

8.2.1 Wet Chemistry

Data reduction for wet chemistry spectrophotometer analyses involves plotting absorbance verses concentration curves for the initial calibration data points. All concentrations reported from continuing calibrations and samples are determined by applying the first order linear regression of the curve to the required absorbances by:

$$C_1 = MX + B$$

where,

C_1 = concentration

M = slope of curve

X = absorbance

B = y intercept

$$C_1 \times DF = C_f$$

where,

DF = dilution factor

C_f = concentration final

These calculations are achieved on a statistical calculator with linear regression capabilities.

Data reduction for non-spectrophotometric analyses involves basic weight and volume calculations and is specified in each analyses SOP.

8.2.2 Metals

8.2.2.1

Graphite Furnace and Cold-vapor AA. Data reduction for Graphite Furnace and Cold-vapor AA analyses involves plotting curves of the absorbance verses concentration from the initial calibration curves. All concentrations reported from continuing calibrations and samples are derived from the 1st order linear regression applied to the curve where:

$$C_1 = MX + B$$

where,

C_1 = concentration

M = slope of curve

X = absorbance

B = y intercept

$$C_i \times DF = C_f$$

where,

DF = dilution factor

C_f = concentration final

The instrumentation used for Graphite Furnace and Cold-vapor AA analyses incorporate computers which generate the linear regression and calculate the initial concentration. These instruments produce hard copy reports which contain the curve plots and calculated analytical results.

8.2.2.2 Inductively Coupled Plasma

Data reduction for ICP analysis involves analysis of a blank and standard for each element to be reported. Pre-determined background and interelement correction factors are applied where applicable. All calibration verifications, blanks, samples and QC analyses are calculated against the initial standard to determine concentration. These concentrations are determined using a single peak area calculation.

8.2.3 Organics

Data reduction from organic analyses occurs in two fashions. GC/MS data is computer generated and all calculations, with the exception of dilution factors, are achieved by the instrument software. GC analysis is conducted using an integrator which calculates peak area and all resulting calculations are conducted manually.

8.2.3.1 GC/MS analyses use a computer to calculate reconstruction ion area counts for target compounds and their respective internal standards. Concentrations are determined by the equation below.

$$\text{concentration (ug/L)} = \frac{A_x(I_s)(V_f)}{(A_{is})(RF)(V_o)(V_i)} \times DF$$

where,

A_x	=	Area of characteristic ion for compound measured in unknown
I_s	=	Amount of internal standard injection (ng)
A_{is}	=	Area of characteristic ion for applicable internal standard
RF	=	Response factor (see below)
V_o	=	Volume of sample used (ml) or weight used in soil samples (g)
DF	=	Dilution factor
V_f	=	Volume of final extract (ul)
V_i	=	Volume injected (ul)
RF	=	$(A_x C_{is} / A_{is} C_x)$

where,

A_x	=	Area of characteristic ion for compound measured in standard
A_{is}	=	Area of characteristic ion from the specific internal standard
C_{is}	=	Concentration of the specific internal standard
C_x	=	Concentration of the compound added to the standard

8.2.3.2

Data reduction for GC analyses is achieved by comparison of the average peak area of the calibration curve to the peak area generated from the 12-hour continuing calibration. If the continuing calibration passes all criteria, analysis is initiated. All subsequent results are compounds peak area generated in the sample to the area generated in the continuing calibration. The peak areas are generated on an integrator, and concentrations are determined using an external standard method as follows:

Concentration

$$\text{Aqueous samples} = \frac{(A_x)(A)(V_t)(D)}{(A_s)(V_i)(V_s)} \quad (\text{ug/L})$$

$$\text{Non-aqueous} = \frac{(A_x)(A)(V_t)(D)}{(A_s)(V_i)(W)} \quad (\text{ug/g})$$

where,

A_x = Peak area of analyte in sample
 A = Amount of standard injected
 A_s = Area of analyte peak in standard
 V_i = Volume of extract injected (ul)
 V_t = Volume of total extract (ul)
 V_s = Volume of sample extracted
 W = Weight of sample extracted
 D = Dilution Factor

8.3 Data Validation

Data validation is a multi-step process utilized during each stage of the data acquisition and reporting process. This process was designed to insure that data produced conforms to this QAPP for both accuracy and quality control level.

When data is reported the reviewing analyst must complete and sign the batch analysis QC summary form, see 8.3.1 to 8.3.3.6. This form will list all pertinent information related to the QA/QC associated with that analysis. This form is then given, with the raw data, to a peer analyst for review. The analyst will reproduce all calculations and verify the quality control adherence to the this QAPP. The peer analyst will sign-off on the QC Summary Form. This form containing all QC results, and a list of all applicable samples will be submitted to the QA personnel for review and control charting. If the data generated is of acceptable quality it is forwarded to the reporting section for data entry. Upon completion of data entry, the final report is reviewed by the Laboratory Manager and signed.

In addition to review of all QC results, the QC personnel will be responsible for reviewing a minimum of 10% of the raw data and reproducing all applicable calculations.

The QC personnel will be responsible for maintaining control charts for each test in the laboratory. These charts will be utilized to identify trends in the analysis and to establish operational control limits in the laboratory. Additionally, the QC personnel will insure monthly that all data is filed properly and in complete form.

8.4 Data Reporting/Quality Control Documentation

SIMALABS International has three levels of data deliverables, which are designated Level I, Level II, and Level III.

8.4.1 All levels of reporting includes a cover letter from the laboratory manager specifying the analyses conducted and any pertinent non-routine sample information.

8.4.1.1 Level II and III reports will also include a detailed case narrative discussing unusual issues encountered during analysis and all quality control issues not conforming to the QAPP.

8.4.2 Level I reports will include the following for all analyses:

- Date of sample receipt
- Date of preparation
- Date of analysis
- Analyst
- Matrix
- Laboratory I.D. #
- Client I.D. #
- Analytical method and method number
- Blank data
- Concentrations determined and resulting quantitation limits

8.4.3 Level II reports will include all Level I contents plus the following for all analyses:

- Matrix Spike/Spike Duplicate summaries
- Duplicate summaries
- Surrogate summaries

8.4.4 Level III reports, which are equivalent to CLP data packages in content, will include all Level I contents plus the following:

GC/MS Analyses:

- Surrogate Summary form
- Matrix Spike Summary form
- Blank Summary form
- Tune Check Summary form
- Initial Calibration Summary form
- Continuing Calibration Summary form
- Is Area/Retention Time Summary form
- All Raw Data
- Target Spectra for positive hits with corresponding standard reference spectrum
- Preparation records

GC/HPLC Analyses:

- Surrogate Summary form
- Matrix Spike Summary form
- Blank Summary form
- Initial Calibration Summary form
- Continuing Calibration Summary form
- Retention Time Summary form
- All raw data
- Preparation records

Metals Analyses:

- ICV, CCV Summary form
- ICB, CCB, Prep Blank Summary form
- ICP Interference Check Sample Summary form
- Spike Sample Recovery form
- Duplicate Sample Summary form
- Laboratory Control Sample Summary form
- All Raw Data
- Preparation Records

Wet Chemistry:

- Calibration Curve summaries
- Calibration Check Standard summaries
- Blank summaries
- Duplicate summaries
- Spike Sample summaries
- Raw Data
- Preparation Records

Batch Analysis QC Summary Form

et Chemistry

Analysis Conducted: _____

Preparation Analyst: _____

Informing Analyst: _____

ate of Analysis: _____

Blank Result: _____

Standard Result: _____

Reference Curve Date: _____

uplicate Result: _____

ip. Sample Original Result: _____

Duplicate % Difference: _____

Matrix Spike Result: _____

Amount Spiked: _____

Matrix Spike Sample Orig. Result: _____

MS % Recovery: _____

amples Associated With This Batch (20 maximum):

Please asterisk (*) 10% calculation check

otes: _____

gnatures:

Analyst: _____

Peer Check: _____

QC Review: _____

atch Analysis QC Summary Form

atch Analysis

Matrix: NON-AQUEOUS / AQUEOUS

Analyst Review: _____

Analysis Date: _____

Peer Review: _____

Prep. Analyst: _____

CC Review: _____

Acqu. Analyst: _____

ICP Prep Batch #

STD LOT #

ICV LOT #

CCV LOT #

Element	(mg/L) Prep Blank	% REC Prep Std.	% REC Duplicate	% REC Matrix Spike	CCV/CCB Checks	ICV/ICB Checks	Comments
Arsenic							
ium							
mium							
Chromium							
ad							
Ienium							
Silver							
poer							
1							
Magnesium							
anganese							
kal							
Sodium							
allium							
c							
Antimony							
ryllium							
balt							
Molybdenum							
Peron							
assium							
Vanadium							
Tin							
ontium							
Silicon							
Lithium							
idium							
itanium							

CVAA Prep Batch #

STD. LOT #

ICV/CCV LOT #

mercury							
---------	--	--	--	--	--	--	--

GFAA Prep Batch #

STD. LOT #

ICV/CCV LOT #

Arsenic							
Selenium							
allium							
mium							
Chromium							
ad							
Coer							
Antimony							
Molybdenum							

ch Analysis QC Summary Form

nics Analysis
.1

Table Organized

Check _____

Matrix: AQUEOUS

Analyst Review: _____

Prep. Analyst _____

Peer Review: _____

Acqu. Analyst _____

QC Review: _____

Initial Cal. Date: _____

Continuing Cal. CCG/SPCC Check _____

Sample #	(DCA) Surrogate (76 - 114)	(TOL) Surrogate (88 - 110)	(BFB) Surrogate (88 - 115)	Analysis Date	Analysis Time	Comments
BLK1						
111						
211						
311						
411						
511						
611						
711						
811						
911						
1011						
1111						
1211						
1311						
1411						
1511						
1611						
1711						
1811						
1911						
2011						
MS11						
MSD1						

Spike Recovery Information:

MSO Sample #	MS % Recov.	MSO % Recov.	% RPO	% Rec. Limits	% RPO Limits
1,1-Dichloroethene				61 - 145	14
1,1-Dichloroethane				71 - 120	14
1,2-Dichloroethane				75 - 130	13
1,2-Dichloroethene				76 - 125	13
1,2-Dichloroethane				76 - 127	11

tch Analysis QC Summary Form

anics Analysis

itle Organics

Tune Check: _____

Matrix: NONAQUEOUS Analyst Review: _____

Prep. Analyst: _____ Peer Review: _____

Acqu. Analyst: _____ QC Review: _____

Initial Cal. Date: _____

Continuing Cal. CCOSPCO Check: _____

Sample #	(DCA) Surrogate (70 - 121)	(TOL) Surrogate (81 - 117)	(BFB) Surrogate (74 - 121)	Analysis Date	Analysis Time	Comments:
BLK1						
1)						
2)						
3)						
4)						
5)						
6)						
7)						
8)						
9)						
10)						
11)						
12)						
13)						
14)						
15)						
16)						
17)						
18)						
19)						
20)						
MS1						
MSD1						

Recovery Information:

MS/MSO Sample #:	MS % Recov.	MSD % Recov.	% RPD	% Rec. Limits	% RPD Limits
Dichloroethene				59 - 172	22
Trichloroethene				52 - 137	24
Chlorobenzene				60 - 133	21
Toluene				59 - 129	21
Benzene				66 - 142	21

Batch Analysis QC Summary Form

Batch Analysis

3.3

Matrix: ACQUEOUS

Analyst Review: _____

Prep. Analyst: _____

Peer Review: _____

Acqu. Analyst: _____

QC Review: _____

Initial Cal. Date: _____

Continuing Cal. % Diff Check: _____

Sample #	(TMX) Surrogate (50 - 150)	(DCB) Surrogate (50 - 150)	(TPH) Surrogate (80 - 120)	Analysis Data	Analysis Time	Comments
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
MSI						
31						

Spike Recovery Information:

MS/MSD Sample #:	MS % Recov.	MSD % Recov.	% RPD	% Rec. Limits	% RPD Limits
Diene				56 - 123	15
Hexachlor				40 - 131	20
in				40 - 120	22
Dieldrin				52 - 126	18
in				56 - 121	21
DDT				38 - 127	27
chlor				50 - 150	25
i				80 - 120	25

Batch Analysis QC Summary Form

Analysis

13.3.4

9. Pesticides: TPH

Matrix: NON-AQUEOUS

Prep. Analyst: _____

Acqu. Analyst: _____

Initial Cal. Date: _____

Analyst Review: _____

Peer Review: _____

QC Review: _____

Continuing Cal. % Diff Check _____

Sample #	(TMX) Surrogate (50 - 150)	(DCB) Surrogate (50 - 150)	(TPH) Surrogate (40 - 120)	Analysis Date	Analysis Time	Comments
1)						
2)						
3)						
4)						
5)						
6)						
7)						
8)						
9)						
10)						
11)						
12)						
13)						
14)						
15)						
16)						
17)						
18)						
19)						
20)						
MS)						
21)						

Spike Recovery Information:

MS/MSD Sample #:	MS % Recov.	MSD % Recov.	% RPD	% Rec. Limits	% RPD Limits
Undane				46 - 127	50
Heptachlor				35 - 130	31
in				34 - 132	43
Dieldrin				31 - 134	38
in				42 - 139	45
DOT				23 - 134	50
lor				50 - 150	40
and				60 - 140	40

Sample #	(NBZ) Surrogate (35 - 114)	(FBP) Surrogate (43 - 116)	(TER) Surrogate (33 - 141)	(PHE) Surrogate (10 - 94)	(FLP) Surrogate (2 - 100)	(TBP) Surrogate (10 - 123)	Analysis Date	Analysis Time	Comments:
BLK									
1									
2									
31									
11									
11									
61									
7									
11									
91									
11									
111									
12									
13									
141									
17									
17									
17									
201									
201									
201									

Spike Recovery Information:

MSD Sample #:	MS % Recov.	MSD % Recov.	% RPO	% Rec. Limits	% RPO Limits
1,2,4-Trinitro				39 - 98	23
1,2,4-Trinitro				46 - 118	31
Dinitro				24 - 56	33
Di-n-butylmalat				11 - 117	45
ne				25 - 127	31
N-nitroso-di-n-oro				41 - 115	33
1,4-Dichlorobenz				36 - 97	23
1,4-Dichlorobenz				9 - 103	50
Phenol				12 - 89	42
1,4-Dichlorobenz				27 - 123	45
oro-3-metho				23 - 97	42
1-Nitrophenol				10 - 80	50

Lab Analysis QC Summary Form

Analysis
3.5

Matrix: NON-ACQUEOUS

Analyst Review: _____

Prep. Analyst: _____

Peer Review: _____

Acqu. Analyst: _____

QC Review: _____

Initial Cal. Date: _____

Continuing Cal. CCC/SPCC Check: _____

Sample #	(NEZ) Surrogate (23 - 120)	(FBP) Surrogate (20 - 116)	(TER) Surrogate (18 - 137)	(PHE) Surrogate (24 - 113)	(FLP) Surrogate (25 - 121)	(TEP) Surrogate (19 - 122)	Analysis Date	Analysis Time	Comments:
1)									
2)									
3)									
4)									
5)									
6)									
7)									
8)									
9)									
10)									
11)									
12)									
13)									
14)									
15)									
16)									
17)									
18)									
19)									
20)									
21)									
22)									

Spike Recovery Information:
MS/MSD Sample #:

	MS % Recov.	MSD % Recov.	% RPD	% Rec. Limits	% RPD Limits
1,2,4-Trichlorobenzene				38 - 107	23
1,2,4-Trichlorobenzene				31 - 137	19
1,2,4-Trichlorobenzene				28 - 89	47
1,2,4-Trichlorobenzene				29 - 135	47
1,2,4-Trichlorobenzene				35 - 142	36
1,2,4-Trichlorobenzene				41 - 126	28
1,2,4-Trichlorobenzene				28 - 104	27
1,2,4-Trichlorobenzene				17 - 109	47
1,2,4-Trichlorobenzene				25 - 90	35
1,2,4-Trichlorobenzene				25 - 102	50
1,2,4-Trichlorobenzene				25 - 103	33
1,2,4-Trichlorobenzene				11 - 114	50

9.0 INTERNAL QUALITY CONTROL

9.1 Quality Control Procedures

The Quality Assurance program at SIMALABS International includes, at a minimum, utilization of five main quality control points to insure integrity of sample data. These quality control procedures include analysis of method blanks, duplicate samples, matrix spikes, control samples, reference standards and surrogate spikes.

9.1.1 Method Blanks (all analyses)

Method blanks are prepared with each batch of samples where 1 batch equals a maximum of 20 samples. The purpose of preparing method blanks is to detect possible contamination in the preparation or analysis of samples. The method blank consists of reagent water which is prepared and analyzed concurrently with the samples in the specific batch. If contamination is detected, the analysis is halted and the problem is rectified.

9.1.2 Duplicate Analyses (MS/MSD)

Duplicate analyses are performed on a randomly selected sample in each preparation batch (maximum 20 samples).

If duplicate results do not fall into specified compliance ranges, the entire batch is rejected, unless investigation determines that the difference is related to matrix interference or matrix inconsistency. Duplicate analyses are evaluated as follows:

$$\text{Duplicate Percent Difference} = \frac{A - B}{C} (100)$$

where,

$$C = \frac{A + B}{2}$$

and,

A = First sample result
B = Second sample result
C = Average of first and second results

9.1.3 Matrix Spikes (all samples)

Matrix spikes are performed on a randomly selected sample within a batch, where a batch set does not exceed 20 samples. Matrix spikes are samples fortified with a known quantity of reagent grade analyte prior to sample preparation. Matrix spike analyses are conducted to reveal possible matrix effects on sample results, such as interference or suppression. Matrix spikes are evaluated as follows:

$$\text{Percent recovery} = \frac{A - B}{C} \times 100$$

where,

A = concentration of spiked sample
B = concentration of unspiked sample
C = concentration of spike added

Matrix spike recoveries falling outside our statistically based acceptance criteria will result in rejection of the analytical data or other corrective action as applicable.

9.1.4 Matrix Spike Duplicates (all analyses)

Matrix spike duplicates are performed on the same sample as matrix spikes. The frequency of analysis is one per batch of 20 or fewer samples. The percent recoveries for matrix spike duplicates are calculated as above (see equation, section 9.1.3) for each analyte. Additionally, the Relative Percent Differences (RPD) between the matrix spike and matrix spike duplicate is calculated and used to assess analytical precision. RPD is calculated as follows:

$$\text{RPD} = \frac{C_1 - C_2}{1/2 (C_1 + C_2)} \times 100\%$$

where,

C_1 = result of the matrix spike
 C_2 = result of the matrix spike duplication

9.1.5 Surrogate spikes (Organic compounds)

Surrogate compounds are spiked into organic samples to monitor preparation procedures used. Recoveries are calculated using:

$$\% \text{ Recovery} = \frac{C_1}{C_A} \times 100$$

where,

C_1 = concentration recovered
 C_A = concentration of analyte added

9.1.6 Reference Standards

Reference standards are standards of a different source than our running standards. These reference standards will be analyzed when a new lot of running standard is used. Use of these standards will reveal problems in our primary stock standards and preparation of running standard.

9.1.7 Control Samples (All analyses)

Control samples consist of deionized water spiked with known concentrations of the analytes of concern. Control sample results are used to evaluate the quality of preparation procedures, and to monitor the analysis process.

9.1.8 Field/Trip Blanks (All analyses)

Field and trip blanks may be provided by the sampling entity. These blanks are treated in the same fashion as field samples. Analysis of these blanks is used to identify possible contamination occurring in field sampling activities. Detected contamination will be reported to the client, for determination of corrective action.

9.1.9 Field Duplicates (All analyses)

Field duplicates may be provided by the ~~sampling entity~~. ~~These duplicates are analyzed~~ in the same fashion as field samples. Analysis of these duplicates is used to assess analytical precision, and representativeness of field sampling activities.

9.1.10 Analytical Spikes (Graphite Furnace analyses)

Analytical spikes are post-digestion spikes conducted on samples. These spikes are utilized when interferences are indicated by bad sample exposure RSD's. Analytical spike results are used to determine whether dilution or Method of Standard Additions(MSA) are required.

9.1.11 Internal Standard Areas (GC/MS analyses)

Internal area responses are monitored for GC/MS analyses to insure consistent response of the analytical system. Internal standard areas will be evaluated against -50% to +100% of the corresponding continuing calibration internal standard area.

9.1.12 Mass Tuning (GC/MS analyses)

Mass tuning is verified using 4-Bromofluorobenzene for volatiles, and Decafluorotriphenylphosphine(DFTPP) and will occur at the beginning of every 12 hour sequence. These tune checks are analyzed to ensure the representativeness and reproducibility of all mass spectra generated. The specific acceptance criteria are stated in the individual SOP's.

9.1.13 Endrin/DDT Degradation Checks (Pesticide analysis)

Breakdown of Endrin and DDT are assessed prior to analysis of pesticide constituents. The breakdown is measured by calculating the concentration of DDD, DDE, Endrin Aldehyde, Endrin Ketone, and the originally introduced Endrin and DDT.

9.1.14 Second Column Confirmation (GC/ECD analysis)

A second column of dissimilar polarity is used to confirm the identity of PCB's or pesticides detected in the primary column.

10.0 PERFORMANCE AND SYSTEM AUDITS

10.1 Introduction

Performance and system audits are the responsibility of Quality Assurance personnel. Performance audits are conducted quarterly, and system audits are conducted annually. These audits are designed to assess the quality of the total laboratory operation and to assure adherence to the quality control procedures specified in this QAPP.

10.2 Performance Audits

10.2.1 A performance audit is a quarterly check by Quality Assurance personnel of the major analyses conducted in the laboratory. This audit consists of, but is not limited to:

- A blind check sample for each department.
- Determination that proper quality control and corrective action procedures were employed in analysis of the blind sample.
- Oversight of all analysts performing their major job function.
- Insure proper technique
- Adherence to the SIMALABS International operational SOP

A report of deficiencies determined in the performance audit will be submitted to laboratory management and immediate corrective action procedures will be adopted.

10.3 System Audits

System audits are annual checks performed by quality assurance personnel of the entire laboratory operation. This audit consists of cradle to grave tracking of randomly selected samples through the entire analysis process. The audit contents will consist of, but not be limited to:

- Sample receipt practices, chain of custody
- Analysis
- Adherence to SOP
- Proper quality control
- Proper corrective-action documentation
- Records keeping and data storage
- Instrument prevention maintenance
- Review of final report

10.3.1 Deficiencies determined in the system audit will be reported management and immediate corrective action procedures will be implemented.

REVENTATIVE MAINTENANCE

Table 11.0

order to assure high quality analytical results, SIMALABS International has employed specific and detailed schedules of preventative maintenance on all equipment. The following schedule details the work to be performed:

Instrument	Serial No.	Each Use	As Needed	Quarterly	Annually
	2061166	Clean Align lamp Align burner	Dust & clean Clean optics	Disassemble nebulizer and clean	Check gaskets and O-rings
aphite Furnace	2041012	Clean Align lamp Align burner	Dust & clean Clean optics	Disassemble nebulizer and clean	Check gaskets and O-rings
	1338	Clean auto sampler parts	Clean nebulizer background readjust	Dust & clean interior, lubricate auto sampler	Maintain chiller
VOA GC/MS	3115A34915 3114A02148	Column maintenance	Clean source	Change pump oil	N/A
arge & Trap	91133001 91108017	Clean purge vessels	Replace trap	Leak check	Replace worn tubing
SVOA GC/MS	3223A43647 3222A03781	Column Maintenance	Clean source	Change pump oil	N/A
Infrared Spectrometer	64192	Clean cell	Replace lamp	N/A	N/A
PLC	54IN2052904 250N2033101 143437 35607 2145 CC3910573	Purge system flush injector	Replace UV and fluorescent lamps replace column	N/A	Lubricate + replace seals
GC FID/ECD	3115A35056	Column maintenance	Replace column	Clean ECD, FID	ECD wipe test
Spec 20	3323056019	Clean cuvetts	Replace lamps	N/A	N/A
chat FIA	A83000-466	Clean pump Clean autosampler	Change o-rings, pump tubing	Lubricate, pump rollers, autosampler	Clean all surfaces
pH Meter 1	C0004246	Calibrate meter daily	Check, clean & repack electrode	N/A	N/A
Meter 2	C0013105	Calibrate meter daily	Check, clean & repack electrode	N/A	N/A

Instrument	Serial No.	Each Use	As Needed	Quarterly	Annually
Conductivity meter	24020015	Calibrate standard with KCl	Clean electrode	N/A	N/A
Top Loading Balance	K14382	Clean after each use	Calibrate daily	N/A	External calibration by service engineer
an Balance 1	0066806	Clean after each use	Calibrate daily	N/A	External calibration by service engineer
an Balance 2	BO-40564	each use	Calibrate daily	N/A	
an Balance 3	L-58817	Clean after each use	Calibrate daily	N/A	External calibration by service engineer
Fisher Oven 104 deg. C	30400156	Check temperature	Record temperature daily	N/A	Oil motor if applicable
Baxter Oven 180 deg. C	0191-0190	Check temperature	Record temperature daily	N/A	Oil motor if applicable
alk-in cooler	938184	Check temperature	Record temperature daily	N/A	N/A
water	N/A	Check specific conductance	Record Specific Conductance daily	Replace resin bed & filters as necessary	N/A

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

12.1 Assessment of Accuracy

12.1.1 Accuracy will be evaluated by comparing the mean recovery of surrogate compounds or spiked analytes against the goals identified in Section 3.0 of this manual. The recovery of a surrogate compound will be defined as:

$$\% \text{ Recovery} = \frac{\text{amount of surrogate found in sample}}{\text{amount of surrogate added to sample}} \times 100\%$$

12.1.2 The recovery of a spiked analyte will be defined as:

$$\% \text{ Recovery} = \frac{\text{total analyte found} - \text{analyte originally present}}{\text{Analyte Added}} \times 100\%$$

12.2 Calculation of Mean Values and Estimates of Precision

12.2.1 The mean value, C , of a series of replicate measurements of concentration C_i , is calculated as:

$$C = \frac{\sum_{i=1}^N C_i}{N}$$

where,

N = number of replicate measurements

C and C_i are both in mg/L or mg/Kg

12.2.2 The estimate of precision of duplicate measurements is expressed the relative percent difference (RPD), where

$$\text{RPD} = \frac{C_2 - C_1}{C} \times 100\%$$

The relative percent difference will be compared with the respective goals identified in Section 3.0 of this QAPP.

12.2.3 The estimate of precision of a series of replicate measurements (primarily used in GC/MS analyses) is expressed as the relative standard deviation (RSD), where

$$\text{SD} = \sqrt{\frac{\sum_{i=1}^N (C - C_i)^2}{N - 1}}$$

and

$$RSD = \frac{SD}{C} \times 100\%$$

where,

C = mean concentration as calculated in 12.2.1

C_i = replicate concentration

N = number of replicate measurements

12.3 Completeness

Completeness will be evaluated by comparing the number of samples acquired for analysis with the number of samples analyzed, as follows:

Degree of completeness =

$$\frac{\text{Total number of samples for which acceptable analytical data are generated}}{\text{Total number of samples acquired for analysis}} \times 100\%$$

Completeness should always be 100% unless dictated by client.

13.0 CORRECTIVE ACTION

13.1 Introduction

Corrective action procedures (CAP's) are employed when blanks, duplicates, spikes, surrogates or other quality control measures are outside the limits established in this QAPP. It is the responsibility of the analyst to initiate CAP's. It is the responsibility of the QC Officer to implement CAP's. It is the responsibility of the analyst and the QC Officer to develop CAP's. It is the responsibility of the QC Officer and the Assistant Laboratory Manager to approve CAP's.

13.2 Blanks

All analytical methods utilized in the laboratory, incorporate blanks to check for contamination. If a blank demonstrates contamination higher than the quantitation limit for any analyte, analysis will be terminated and the source of the contamination will be determined. Analysis will proceed only when the contamination has been eliminated.

13.3 Duplicates

Duplicate analysis must fall within the % Difference limits established in Section 3.1 of this QAPP. If duplicates do not fall within these limits, re-analysis or other measures are employed to determine if the cause is matrix interference. If matrix interference is determined, analysis may proceed. If no evidence of matrix problems exists, then analysis is terminated and the samples are re-prepared and re-analyzed.

13.4 Matrix Spikes/Matrix Spike Duplicates

Matrix Spike recoveries must fall within the limits established in Section 3.1 of this QAPP. If Matrix Spike recoveries are not within these limits, re-analysis or other measures are employed to determine if the cause is matrix interference. If matrix interference is determined, analysis may proceed. If no evidence of matrix problems exists, then analysis is terminated and the samples are re-prepared and re-analyzed.

13.5 Surrogates

Surrogate recoveries must fall within the limits established in Section 3.1 of this QAPP. If surrogates are out, re-analysis is required. If re-analysis indicates that matrix interference exists, analysis may proceed. If re-analysis indicates that no matrix effects are present, the sample must be re-prepared. If surrogate recoveries are out-of-control in blank samples, analysis will terminate and all samples associated with that blank will be re-prepared.

13.6 Exceptions/Documentation

All corrective actions will be documented on a situation-out-of-control form (Example 13.6.1). Any exceptions to the above procedures due to matrix or amount of sample will be specified on this form. Procedures different than those stated above will be used only with the approval of quality assurance personnel.

SIMALABS International
SITUATION-OUT-OF-CONTROL FORM

Date: _____

Analyte: _____

SIMALABS International ID#: _____

Problem: _____

Notification by: _____ Date: _____

Notification to: _____ Date: _____

Resolution: _____

Preventative Action: _____

Resolution / Prevention by: _____ Date: _____

Approved / Issue closed by: _____ Date: _____

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

- 14.1 Section 8.3 establishes the procedures to be utilized in validation of data generated under this QAPP. Quality assurance personnel will be responsible for compiling data and presenting quarterly reports to management.
- 14.2 Quarterly reports will consist of a presentation of all control charted data generated. This will include, where applicable, duplicates, spikes and surrogates recoveries. Additionally, a report will be generated which lists all situation-out-of-control issues.
- 14.3 Quality assurance personnel will issue reports to management when audits are conducted. All findings and recommended corrective-action procedures will be specified.
- 14.4 As specified in this QAPP, blind samples will be submitted to the laboratory personnel. Quality Assurance personnel will be responsible for evaluating the results generated and presenting a report to management on the laboratory's success. This same practice will be employed for evaluation of WP/WS performance evaluation results.

Appendix A

Trace Evaluation Report
Ground Water Pollution Study #PC35

Page: 1
Date: 16APR86

Participant ID: IN00054 Type: OTHER Requesting Office: WI

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
---------------	----------------	-------------	-------------------	----------------	------------------------

TRACE METALS IN MICROGRAMS/LITER

1-ALUMINUM

01	328	321	261- 332	276- 367	Accept.
02	1520	1500	1270- 1700	1330- 1840	Accept.

2-ARSENIC

01	198	193	167- 231	175- 223	Accept.
02	579	571	492- 676	515- 653	Accept.

3-BERYLLIUM

01	176	190	165- 209	170- 204	Accept.
02	526	541	480- 597	495- 583	Accept.

4-CADMIUM

01	51.0	52.6	44.5- 60.7	46.5- 58.7	Accept.
02	399	401	345- 454	359- 440	Accept.

5-COBALT

01	<10.0	28.1	22.9- 32.6	24.1- 31.4	Not Accept.
02	750	624	557- 686	574- 670	Not Accept.

6-CHROMIUM

01	17.4	17.0	13- 20.5	13.9- 19.5	Accept.
02	913	880	767- 985	794- 958	Accept.

7-COPPER

01	86.0	86.7	75.5- 96.9	78.2- 94.2	Accept.
02	373	370	334- 409	344- 399	Accept.

8-IRON

01	37.0	30.4	18.8- 42.6	21.8- 39.6	Accept.
02	481	454	441- 519	451- 509	Accept.

9-MERCURY

01	3.21	3.10	2.03- 4.07	2.29- 3.81	Accept.
02	11.3	11.6	8.65- 14.7	9.41- 13.9	Accept.

10-MANGANESE

01	402	401	369- 441	378- 432	Accept.
02	892	881	833- 968	850- 951	Accept.

11-NICKEL

01	495	496	453- 560	466- 547	Accept.
02	620	611	557- 698	574- 680	Accept.

12-LEAD

01	344	297	259- 334	269- 325	Not Accept.
02	427	399	356- 446	367- 435	Accept.

13-SELENIUM

01	470	522	402- 615	429- 586	Accept.
02	859	978	754- 1150	804- 1100	Accept.

14-VANADIUM

01	212	211	136- 234	192- 228	Accept.
02	827	811	724- 888	745- 867	Accept.

15-ZINC

01	77.0	71.9	62.7- 84.9	65.5- 82.2	Accept.
02	1900	1800	1610- 2030	1660- 1980	Accept.

Performance Evaluation Report
USEPA Water Pollution Study WFO35

Page: 2
Date: 16APR96

Participant ID: INGC054

Type: OTHER

Requesting Office: WI

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
ANTIMONY					
03	282	370	240- 450	266- 423	Accept.
04	613	570	369- 692	410- 651	Accept.
SILVER					
03	190	180	153- 207	160- 200	Accept.
04	370	340	298- 391	310- 380	Accept.
THALLIUM					
03	85.2	83.3	63.4- 99.1	67.9- 94.6	Accept.
04	360	365	301- 425	317- 410	Accept.
MOLYBDENUM					
03	127	130	106- 151	112- 146	Accept.
04	346	310	257- 358	270- 345	Ck. for Err.
STRONTIUM					
03	3.60	3.55	2.56- 4.49	2.81- 4.23	Accept.
04	92.7	96.0	79.8- 110	83.9- 106	Accept.
TITANIUM					
03	124	115	96.8- 130	101- 126	Accept.
04	294	270	230- 302	239- 293	Accept.
MINERALS IN MILLIGRAMS/LITER (EXCEPT AS NOTED)					
PH-UNITS					
03	4.34	4.30	4.22- 4.4	4.25- 4.32	Accept.
04	5.54	5.50	5.46- 5.62	5.48- 5.6	Accept.
SPEC. COND. (UMHOS/CM AT 25 C)					
01	892	916	830- 933	849- 964	Accept.
02	575	585	536- 627	547- 616	Accept.
TDS AT 180 C					
01	485	553	326- 762	280- 708	Accept.
02	299	311	226- 393	243- 377	Accept.
TOTAL HARDNESS (AS CaCO3)					
01	364	330	302- 358	309- 351	Not Accept.
02	114	101	90.8- 110	93.2- 108	Not Accept.
CALCIUM					
01	114	104	92.8- 120	96.2- 116	Accept.
02	7.12	6.39	5.53- 7.54	5.70- 7.29	Accept.
MAGNESIUM					
01	19.4	17.0	15.2- 19.3	15.7- 18.7	Not Accept.
02	23.5	20.6	18- 23.6	18.7- 22.0	Ck. for Err.
SODIUM					
01	15.0	14.2	13.1- 16.2	13.5- 15.8	Accept.
02	52.6	54.3	49.3- 58.9	50.5- 57.7	Accept.
POTASSIUM					
01	21.8	21.0	19.8- 23.7	19.4- 23.1	Accept.
02	38.3	38.3	33.3- 41.7	34.3- 40.7	Accept.
CHLORIDE					
01	246	241	224- 259	228- 254	Accept.
02	75.0	72.7	65.1- 79.3	67- 77.5	Accept.

Performance Evaluation Report
USEPA Water Pollution Study W9035

Page: 3
Date: 16 APR 86

Participant ID: INC0054

Type: OTHER

Requesting Office: XI

Sample Number	Reported Value	True Value*	Acceptance Limits	Variance Limits	Performance Evaluation
-FLUORIDE					
G1	3.59	3.50	3.09- 3.8	3.18- 3.71	Accept.
G2	1.48	1.35	1.16- 1.53	1.21- 1.48	Accept.
-SULFATE					
G1	15.6	18.0	13.8- 22.1	14.8- 21.1	Accept.
G2	39.6	86.4	72- 97	75.1- 93.9	Not Accept.
NUTRIENTS IN MILLIGRAMS/LITER					
1-AMMONIA-NITROGEN					
G1	4.70	19.0	15- 22.3	15.9- 21.5	Not Accept.
G2	1.81	1.40	1.15- 2.08	1.26- 1.97	Accept.
2-NITRATE-NITROGEN					
G1	11.2	8.31	6.76- 9.69	7.11- 9.34	Not Accept.
G2	0.638	0.390	0.28-0.495	0.305-0.469	Not Accept.
3-ORTHOPHOSPHATE					
G1	0.049	.0560	0.0333-0.076	0.0384-0.071	Accept.
G2	2.78	2.80	2.43- 3.19	2.52- 3.1	Accept.
4-KJELDAHL-NITROGEN					
G3	0.860	0.580	0.115- 1.12	0.235-0.995	Accept.
G4	9.28	7.90	5.73- 9.84	6.2- 9.17	Ok. for Err.
5-TOTAL PHOSPHORUS					
G3	0.537	0.574	0.47-0.705	0.498-0.677	Accept.
G4	5.50	6.08	5.16- 7.2	5.41- 6.96	Accept.
DEMANDS IN MILLIGRAMS/LITER					
COD					
G1	240	236	189- 259	199- 250	Accept.
G2	94.7	101	71.2- 120	77.3- 114	Accept.
5-DAY BOD					
G1	107	141	64.1- 218	83.3- 190	Accept.
G2	51.7	62.5	29.5- 95.5	37.7- 87.3	Accept.
CARBONACEOUS BOD					
G1	103	117	34.3- 199	55.6- 178	Accept.
G2	45.0	51.6	20- 83.2	28.2- 75	Accept.
PCB'S IN MICROGRAMS/LITER					
PCB-AROCLO 1232					
G1	2.27	2.75	0.709- 4.3	1.17- 3.84	Accept.
PCB-AROCLO 1240					
G2	3.35	4.25	1.77- 6.04	2.3- 5.5	Accept.
PCB'S IN CIL IN MILLIGRAMS/KILOGRAM					
PCB IN CIL- 1016/1202					
G1	2.23	42.3	6.88- 59.9	13.5- 52.3	Not Accept.
PCB IN CIL- 1260					
G2	1.65	12.7	3.17- 20.4	5.37- 18.2	Not Accept.

Participant ID: IN00054

Type: CTRBS

Requesting Office: WI

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
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PESTICIDES IN MICROGRAMS/LITER

-ALDRIN

01	3.36	3.11	0.522- 5.23	1.12- 4.64	Accept.
02	0.184	0.243	0.065-0.322	0.077-0.289	Accept.

-DIELDRIN

01	4.77	4.51	2.62- 6.22	3.08- 5.76	Accept.
02	1.37	1.62	0.856- 2.19	1.03- 2.02	Accept.

-DDD

01	6.48	5.67	3.14- 9.33	3.92- 8.55	Accept.
02	1.62	1.94	1.21- 2.64	1.39- 2.46	Accept.

-DDE

01	3.93	3.76	2.14- 5.1	2.51- 4.73	Accept.
02	1.16	1.42	0.72- 1.85	0.863- 1.71	Accept.

1-DDT

01	7.00	6.46	3.79- 9.28	4.42- 8.59	Accept.
02	1.54	1.76	0.865- 2.33	1.05- 2.14	Accept.

2-HEPTACHLOR

01	2.90	2.85	0.694- 4.14	1.13- 3.71	Accept.
02	0.267	0.279	0.0899-0.374	0.126-0.338	Accept.

3-CHLORLANE

03	9.76	12.3	4.69- 17.2	6.27- 15.6	Accept.
04	1.20	1.36	0.695- 1.81	0.835- 1.67	Accept.

2-HEPTACHLOR EPOXIDE

01	2.12	2.20	1.13- 2.53	1.31- 2.35	Accept.
02	0.265	0.284	0.153- 0.37	0.18-0.342	Accept.

VOLATILE HALOCARBONS IN MICROGRAMS/LITER

1,2-DICHLOROETHANE

01	56.7	56.3	39- 79.4	44.1- 74.4	Accept.
02	12.9	12.2	8.5- 17.5	9.63- 16.4	Accept.

CHLOROFORM

01	70.5	64.8	47.6- 83.2	52.1- 78.7	Accept.
02	16.5	14.2	11- 18.4	11.9- 17.4	Accept.

1,1,1-TRICHLOROETHANE

01	66.3	63.7	41- 85.7	46.6- 80.1	Accept.
02	17.4	16.2	10.4- 22.2	11.9- 20.7	Accept.

1,1,1-TRICHLOROETHENE

01	76.7	72.3	45.7- 93	51.6- 87.1	Accept.
02	16.9	16.1	10.7- 20.6	11.9- 19.4	Accept.

1-CARBONTETRACHLORIDE

01	33.5	29.0	16.5- 45	20- 41.4	Accept.
02	11.1	9.36	5.61- 13.7	6.62- 12.7	Accept.

1-TETRACHLOROETHENE

01	73.7	73.6	46.5- 96.3	52.7- 90.1	Accept.
02	11.2	10.4	6.04- 14.5	7.1- 13.4	Accept.

2-BROMODICHLOROMETHANE

01	58.3	55.6	37- 73.1	41.6- 68.6	Accept.
02	15.5	14.6	10.2- 18.4	11.2- 17.3	Accept.

Performance Evaluation Report
USEPA Water Pollution Study WP036

Report: FE005
Page: 1
Date: 07NOV96

Participant ID: IM00054

Type: OTHER

Requesting Office: 805

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
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TRACE METALS IN MICROGRAMS/LITER

ALUMINUM

01	3600	3609	3130- 4040	3250- 3920	Accept.
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ARSENIC

01	256	250	210- 292	220- 282	Accept.
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BERYLLIUM

01	51.1	51.1	39.9- 62.9	42.8- 60	Accept.
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CADMIUM

01	136	131	113- 143	117- 144	Accept.
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COBALT

01	461	433	386- 497	400- 483	Accept.
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CHROMIUM

01	263	250	218- 289	227- 280	Accept.
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COPPER

01	571	552	515- 618	528- 605	Accept.
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IRON

01	858	790	715- 934	742- 906	Accept.
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MERCURY

01	4.96	4.70	3.53- 5.91	3.83- 5.61	Accept.
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MANGANESE

01	784	750	686- 812	702- 797	Accept.
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NICKEL

01	1920	1812	1660- 2030	1710- 1990	Accept.
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LEAD

01	380	375	332- 429	344- 417	Accept.
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SELENIUM

01	121	310	244- 360	258- 345	Not Accept.
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VANADIUM

01	6950	6662	5980- 7620	6180- 7410	Accept.
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ZINC

01	1290	1203	1100- 1370	1140- 1340	Accept.
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ANTIMONY

02	711	891	590- 1070	650- 1010	Accept.
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SILVER

02	576	573	448- 659	474- 633	Accept.
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THALLIUM

02	737	787	630- 908	665- 873	Accept.
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MOLYBDENUM

02	491	473	403- 536	420- 519	Accept.
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STRONTIUM

02	246	243	206- 277	215- 268	Accept.
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MINERALS IN MILLIGRAMS/LITER (EXCEPT AS NOTED)

FE-UNITS

02	8.77	8.73	8.54- 9.01	8.6- 8.95	Accept.
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Performance Evaluation Report
US EPA Water Pollution Study WPO36

Report: PEC05
Page: 2
Date: 07NOV96

Participant ID: IN00054

Type: CTRFE

Requesting Office: F05

Sample Number	Reported Value	True Value±	Acceptance Limits	Warning Limits	Performance Evaluation
0-SPEC. COND. (UMHCS/CM AT 25 C)					
01	266	269	251- 293	256- 288	Accept.
-TDS AT 180 C					
01	159	148	104- 187	114- 177	Accept.
2-TOTAL HARDNESS (AS CaCO3)					
01	50.4	47.4	42.5- 53.7	43.9- 52.3	Accept.
-CALCIUM					
01	18.0	17.0	14.8- 19.5	15.4- 18.9	Accept.
-MAGNESIUM					
01	1.33	1.20	0.983- 1.42	1.04- 1.37	Accept.
5-SODIUM					
01	7.72	7.46	6.55- 9.17	6.83- 8.85	Accept.
-POTASSIUM					
01	33.8	33.1	30.5- 37.5	31.4- 36.6	Accept.
7-TOTAL ALKALINITY (AS CaCO3)					
01	14.5	13.0	9.69- 16.8	10.6- 15.9	Accept.
-CHLORIDE					
01	40.0	34.8	30.8- 38.4	31.8- 37.4	Not Accept.
-FLUORIDE					
01	0.183	0.210	0.153- 0.27	0.168- 0.255	Accept.
0-SULFATE					
01	46.7	44.0	36.4- 49.1	37.9- 47.5	Accept.
NUTRIENTS IN MILLIGRAMS/LITER					
-AMMONIA-NITROGEN					
01	10.0	10.0	8.05- 12	8.52- 11.5	Accept.
-NITRATE-NITROGEN					
01	2.03	2.10	1.73- 2.48	1.82- 2.39	Accept.
-ORTHOPHOSPHATE					
01	0.898	0.880	0.768- 1.02	0.798- 0.988	Accept.
4-KJELDAHL-NITROGEN					
02	8.43	8.90	6.62- 10.9	7.13- 10.4	Accept.
-TOTAL PHOSPHORUS					
02	2.67	2.90	2.46- 3.43	2.59- 3.31	Accept.
DEMANDS IN MILLIGRAMS/LITER					
-COD					
01	18.6	20.8	10.7- 32.2	13.5- 29.5	Accept.
5-DAY BOD					
01	12.6	13.0	6.59- 19.2	8.44- 17.7	Accept.
2-CARBONACEOUS BOD					
01	12.4	11.3	5.33- 17.3	6.93- 15.7	Accept.
PCB'S IN MICROGRAMS/LITER					
-PCB-ARCCLO 1016/1242					
02	1.99	3.85	1.48- 4.82	1.9- 4.4	Accept.

Performance Evaluation Report
USEPA Water Pollution Study #P036

Report: FE005
Page: 3
Date: 07NOV96

Participant ID: INC0054

Type: OTHER

Requesting Office: R05

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
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15-PCB-AECCLOL 1254

01	1.45	1.78	0.627- 2.59	0.875- 2.35	Accept.
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PCB'S IN OIL IN MILLIGRAMS/KILOGRAM

16-PCB IN OIL- 1016/1242

02	14.3	17.9	1.13- 28.8	4.68- 25.3	Accept.
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10-PCB IN OIL- 1254

01	14.5	15.9	0.227- 28.6	3.9- 24.9	Accept.
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PESTICIDES IN MICROGRAMS/LITER

17-ALDRIN

01	0.244	0.313	0.0856-0.425	0.129-0.382	Accept.
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18-DIELDHIN

01	1.01	1.24	0.675- 1.68	0.803- 1.55	Accept.
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19-DDD

01	1.87	2.35	1.27- 3.29	1.52- 3.03	Accept.
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20-DDE

01	0.942	1.18	0.605- 1.55	0.725- 1.43	Accept.
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21-DDT

01	1.67	2.05	1.07- 2.68	1.27- 2.48	Accept.
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22-HEPTACHLOR

01	0.288	0.386	0.119-0.525	0.171-0.473	Accept.
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23-CHLORDANE

03	1.98	2.34	1.14- 3.33	1.42- 3.06	Accept.
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24-HEPTACHLOR EPOXIDE

01	0.160	0.222	0.118-0.285	0.139-0.264	Accept.
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VOLATILE HALOCARBONS IN MICROGRAMS/LITER

25-1,2 DICHLOROETHANE

01	12.7	10.5	8.14- 15.8	9.1- 14.9	Accept.
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26-CHLOROFORM

01	12.7	11.1	8.85- 14.6	9.57- 13.9	Accept.
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27-1,1,1 TRICHLOROETHANE

01	13.0	11.7	8.67- 15.8	9.56- 14.9	Accept.
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28-TRICHLOROETHENE

01	15.7	14.7	10- 19.5	11.2- 18.3	Accept.
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29-CARBONTETRACHLORIDE

01	15.9	13.3	8.7- 20.4	10.2- 18.9	Accept.
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30-TETRACHLOROETHENE

01	14.4	14.5	9.56- 19.2	10.8- 18	Accept.
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31-BROMODICHLOROMETHANE

01	13.1	12.0	8.48- 15.6	9.37- 14.7	Accept.
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32-DIBROMOCHLOROMETHANE

01	13.6	11.7	9.22- 15.9	10- 15	Accept.
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33-BROMOCHLOROMETHANE

01	14.2	16.3	11.9- 22.8	13.3- 21.5	Accept.
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Performance Evaluation Report
USZP3 Water Pollution Study WP036

Report: PE005
Page: 4
Date: 07NOV96

Participant ID: IN00054

Type: OTHER

Requesting Office: R05

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
METHYLENE CHLORIDE					
C1	15.9	16.4	12.6- 24.4	14.1- 22.9	Accept.
CHLOROBENZENE					
01	14.5	13.6	10.9- 17.6	11.8- 16.8	Accept.
VOLATILE AROMATICS IN MICROGRAMS/LITER					
BENZENE					
01	21.1	18.6	14.1- 24.3	15.4- 23	Accept.
1,2-DICHLOROBENZENE					
01	19.3	19.8	13.8- 25.4	15.3- 23.9	Accept.
1,3-DICHLOROBENZENE					
01	17.8	17.0	12.4- 22	13.6- 20.8	Accept.
1,4-DICHLOROBENZENE					
C1	7.98	9.19	6.42- 12.4	7.17- 11.7	Accept.
1,3-DICHLOROBENZENE					
C1	5.94	7.60	5.23- 10.2	5.87- 9.6	Accept.
1,3-DICHLOROBENZENE					
01	7.23	8.40	5.73- 10.9	6.38- 10.3	Accept.
MISCELLANEOUS PARAMETERS					
TOTAL CYANIDE (IN MG/L)					
C1	0.930	0.921	0.645- 1.18	0.712- 1.11	Accept.
NON-FILTERABLE RESIDUE (IN MG/L)					
01	21.7	30.0	20.1- 31.4	21.5- 30	Accept.
OIL AND GREASE (IN MG/L)					
C1	17.7	19.5	11.9- 23.9	13.4- 22.4	Accept.
TOTAL PHENOLICS (IN MG/L)					
C1	0.517	0.483	0.27-0.697	0.325-0.642	Accept.
TOTAL RESIDUAL CHLORINE (IN MG/L)					
01	0.697	0.690	0.543-0.834	0.581-0.796	Accept.

***** END OF DATA FOR IN00054 *****

: FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.

***** END OF REPORT FOR IN00054 *****

used on gravimetric calculations, or a reference value when necessary.

Performance Evaluation Report
USEPA Water Pollution Study WPCBS

Page: 5
Date: 16APR86

Participant ID: IN00054 Type: OTHER Requesting Office: WI

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
1,1-DIBROMOCHLOROMETHANE					
C1	54.5	48.5	33.1- 63.4	37- 59.6	Accept.
C2	16.8	14.6	9.59- 18.9	16.7- 17.7	Accept.
1,2-DIBROMOETHANE					
C1	48.8	68.0	50.4- 95.3	56- 89.7	Not Accept.
C2	12.8	12.6	8.42- 17.3	9.53- 16.2	Accept.
METHYLENE CHLORIDE					
C1	40.9	46.7	30.3- 64.1	34.6- 59.9	Accept.
C2	14.9	10.3	6.63- 14.7	7.65- 13.7	Not Accept.
CHLOROBENZENE					
C1	77.2	68.1	46.5- 89	51.9- 83.7	Accept.
C2	20.4	17.7	11.7- 24.2	13.2- 22.6	Accept.
1,2,3,4-TETRACHLOROBENZENE					
C1	54.4	55.9	40.7- 69.9	44.4- 66.2	Accept.
C2	10.6	9.30	6.56- 12.3	7.23- 11.6	Accept.
1,4-DIMETHYLBENZENE					
C1	48.3	56.4	38.7- 73.3	43- 69	Accept.
C2	10.7	10.4	7.18- 13.6	7.99- 12.8	Accept.
1,2,4-TRIMETHYLBENZENE					
C1	41.8	44.7	30.9- 57.6	34.3- 54.2	Accept.
C2	8.26	7.60	5.29- 9.97	5.88- 9.38	Accept.
1,2-DICHLOROBENZENE					
C1	57.5	52.0	40.7- 66.5	44- 63.2	Accept.
C2	15.5	11.7	7.82- 16.6	8.92- 15.5	Accept.
1,4-DICHLOROBENZENE					
C1	47.4	48.3	33.3- 62.2	37- 58.5	Accept.
C2	14.7	13.4	9.37- 17.6	10.4- 16.6	Accept.
1,3-DICHLOROBENZENE					
C1	41.5	42.7	34.4- 53.1	36.7- 50.7	Accept.
C2	14.1	12.6	8.8- 16.6	9.79- 15.6	Accept.
MISCELLANEOUS PARAMETERS					
1-TOTAL CYANIDE (IN MG/L)					
C1	0.013	0.0301	0.0138-0.046	0.0179-0.042	Not Accept.
C2	0.201	0.410	0.297-0.522	0.325-0.493	Not Accept.
2-NON-FILTERABLE RESIDUE (IN MG/L)					
C1	71.4	83.0	61.9- 98.1	66.4- 93.6	Accept.
C2	38.4	56.0	42.7- 60.1	44.9- 57.9	Not Accept.
3-OIL AND GREASE (IN MG/L)					
C1	85.6	46.0	29.5- 54.1	32.6- 51	Not Accept.
C2	37.6	18.9	12- 23.2	13.4- 21.8	Not Accept.
4-TOTAL PHENOLICS (IN MG/L)					
C1	2.82	2.71	1.47- 3.96	1.73- 3.64	Accept.
C2	1.15	1.19	0.519- 1.87	0.692- 1.7	Accept.

Performance Evaluation Report
USEPA Water Supply Study W5036

Page: 1
Date: 03NOV95

Participant ID: IN00054

Type: CTBEE

Requesting Office: HCS

	Sample Number	Reported Value	True Value±	Acceptance Limits	Performance Evaluation
TRACE METALS IN MICROGRAMS PER LITER:					
001-ARSENIC	001	125	120	107- 136	Accept.
002-BARIUM	002	1290	1300	1110- 1500	Accept.
003-CADMIUM	001	32.0	34.0	27.2- 40.8	Accept.
004-CHROMIUM	001	31.9	37.8	32.1- 43.5	Not Accept.
005-LEAD	001	34.9	39.0	27.3- 50.7	Accept.
006-MERCURY	001	2.32	3.00	2.1- 3.9	Accept.
007-SELENIUM	001	27.8	31.1	24.9- 37.3	Accept.
008-SILVER	002	55.5	54.2	47.2- 60.2	Accept.
091-COPPER	001	631	630	567- 693	Accept.
140-ANTIMONY	002	<50.0	11.0	7.7- 14.3	Unusable
141-BERYLLIUM	001	6.90	7.70	6.55- 8.86	Accept.
142-NICKEL	001	384	380	323- 437	Accept.
143-THALLIUM	002	4.73	4.50	3.15- 5.85	Accept.
226-BORON	002	488	480	444- 502	Accept.
235-ALUMINUM	001	45.1	51.0	43.2- 67.3	Accept.
236-MANGANESE	001	993	970	911- 1030	Accept.
237-MOLYBDENUM	002	<10.0	11.0	8.29- 13.9	Unusable
239-ZINC	001	1430	1410	1280- 1530	Accept.
NITRATE/NITRITE/FLUORIDE IN MILLIGRAMS PER LITER:					
009-NITRATE AS N	001	4.29	2.90	2.61- 3.19	Not Accept.
010-FLUORIDE	001	7.59	7.20	6.48- 7.92	Accept.
092-NITRITE AS N	001	1.11	1.10	0.935- 1.27	Accept.

Participant ID: IN00054 Type: OTHER Requesting Office: RCS

Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
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INSECTICIDES IN MICROGRAMS PER LITER:

011-ENDESIN	001	0.366	0.383	0.263-0.498	Accept.
012-LINDANE	001	0.311	0.429	0.236-0.622	Accept.
013-METHOXYCHLOR	001	24.3	28.9	15.9- 41.9	Accept.
014-TCIAPHENE	002	10.1	14.7	8.09- 21.3	Accept.
097-CHLORDANE (TOTAL)	003	11.1	16.7	9.19- 24.2	Accept.

ADIPATE/PHTHALATES IN MICROGRAMS PER LITER:

134-BIS (2-ETHYLHEXYL) ADIPATE	001	19.9	16.9	3.26- 25.8	Accept.
135-BUTYL BENZYL PHTHALATE	001	16.5	15.9	1.67- 24.6	Accept.
136-BIS (2-ETHYLHEXYL) PHTHAL.	001	21.3	19.3	4.43- 30.5	Accept.
150-DIETHYL PHTHALATE	001	14.5	23.8	7.98- 37.9	Accept.
151-DIMETHYL PHTHALATE	001	<5.00	27.4	5.33- 38.5	Not Accept.

TRIALOMETHANES IN MICROGRAMS PER LITER:

017-CHLOROFORM	001	23.4	21.7	17.4- 26	Accept.
018-BROMOFORM	001	36.7	38.6	30.9- 46.3	Accept.
019-BROMODICHLOROMETHANE	001	25.4	26.8	21.4- 32.2	Accept.
020-CHLORODIBROMOMETHANE	001	34.2	34.2	27.4- 41	Accept.
021-TOTAL TRIHALOMETHANE	001	120	121.3	97- 146	Accept.

VOIATILE ORGANIC COMPOUNDS IN MICROGRAMS PER LITER:

032-VINYL CHLORIDE	001	8.39	9.47	5.68- 13.3	Accept.
034-1,1-DICHLOROETHYLENE	001	7.38	8.47	5.09- 11.9	Accept.
035-1,2-DICHLOROETHANE	001	9.10	9.00	5.4- 12.6	Accept.
036-1,1,1-TRICHLOROETHANE	001	12.0	14.5	11.6- 17.4	Accept.
037-CARBON TETRACHLORIDE	001	10.5	12.6	10.1- 15.1	Accept.

Performance Evaluation Report
USEPA Water Supply Study WSO36

Page: 3
Date: 03NOV95

Participant ID: IN00054

Type: OTHER

Requesting Office: R05

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation

038-TRICHLOROETHYLENE					
	CC1	14.4	17.4	13.9- 20.9	Accept.
039-BENZENE					
	CC1	7.11	7.49	4.49- 10.5	Accept.
040-TETRACHLOROETHYLENE					
	002	14.8	18.5	14.8- 22.2	Accept.
041-1,4-DICHLOROBENZENE					
	001	10.4	11.9	9.52- 14.3	Accept.
042-1,2 DICHLOROETHYLENE					
	002	11.1	11.6	9.28- 13.9	Accept.
044-1,2 DICHLOROPROPANE					
	CC2	15.0	16.4	13.1- 19.7	Accept.
047-TOLUENE					
	CC2	12.9	13.2	10.6- 15.8	Accept.
048-ETHYLBENZENE					
	002	13.4	14.8	11.8- 17.8	Accept.
049-CHLOROBENZENE					
	002	15.6	16.3	13- 19.6	Accept.
053-STYRENE					
	CC2	12.6	12.9	10.3- 15.5	Accept.
055-DICHLOROMETHANE					
	CC1	11.6	12.3	9.84- 14.8	Accept.
061-1,1,2-TRICHLOROETHANE					
	CC1	6.43	6.46	3.88- 9.04	Accept.
075-1,2,4-TRICHLOROCECENE					
	CC2	14.9	12.6	10.1- 15.1	Accept.
090-TOTAL XYLENES					
	002	11.3	10.4	8.32- 12.5	Accept.
MISCELLANEOUS ANALYTES:					
022-RESIDUAL FREE CHLORINE (MILLIGRAMS PER LITER)					
	001	0.510	0.562	0.408-0.715	Accept.
024-TOTAL FILTERABLE RESIDUE (MILLIGRAMS PER LITER)					
	001	462	380	269- 626	Accept.
025-CALCIUM (MG. CaCO3/L)					
	CC1	245	215	202- 235	Not Accept.
026-PH-UNITS					
	CC1	8.84	9.13	8.85- 9.32	Not Accept.
027-ALKALINITY (MG. CaCO3/L)					
	001	40.0	38.1	36.6- 44.9	Accept.
029-SODIUM (MILLIGRAMS PER LITER)					
	CC1	16.3	17.5	16.5- 20.1	Not Accept.
145-SULFATE (MILLIGRAMS PER LITER)					
	001	74.7	81.0	71.9- 87.6	Accept.
146-TOTAL CYANIDE (MILLIGRAMS PER LITER)					
	001	0.178	0.200	0.15- 0.25	Accept.

Performance Evaluation Report
USEPA Water Supply Study W5037

Report: FE005
Page: 1
Date: 06SEP96

Participant ID: IN00054

Type: OTHER

Requesting Office: IN

Sample Number	Reported Value	True Value±	Acceptance Limits	Performance Evaluation
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TRACE METALS IN MICROGRAMS PER LITER:

001-ARSENIC	001	48.5	49.3	41.9- 56.3	Accept.
002-BARIUM	002	784.	773	657- 889	Accept.
003-CADMIUM	001	10.4	10.2	8.16- 12.2	Accept.
004-CHROMIUM	001	73.2	72.5	62- 83.8	Accept.
005-LEAD	001	13.3	13.3	9.66- 17.9	Accept.
006-MERCURY	001	7.76	8.16	5.71- 10.6	Accept.
007-SELENIUM	001	62.7	57.9	46.3- 69.5	Accept.
091-COPPER	001	55.5	55.7	50.1- 61.3	Accept.
140-ANTIMONY	002	19.2	18.0	12.6- 23.4	Accept.
141-BERYLLIUM	001	4.20	4.26	3.62- 4.9	Accept.
142-NICKEL	001	54.3	55.0	46.8- 63.3	Accept.
143-THALLIUM	002	2.67	2.38	1.67- 3.09	Accept.
226-CHROM	002	1000.	929	876- 1030	Accept.
236-MANGANESE	001	49.5	48.1	43- 51.4	Accept.
237-MOLYBDENUM	002	53.8	54.0	42.6- 65.4	Accept.
239-ZINC	001	619.	600	536- 652	Accept.

NITRATE/NITRITE/FLOURIDE IN MILLIGRAMS PER LITER:

009-NITRATE AS N	001	9.20	8.30	7.47- 9.13	Not Accept.
092-NITRITE AS N	001	0.544	0.502	0.427-0.577	Accept.
261-ORTHOPHOSPHATE AS P	001	1.17	1.10	0.957- 1.21	Accept.

INSECTICIDES IN MICROGRAMS PER LITER:

011-ENDRIN	001	0.218	0.231	0.162- 0.3	Accept.
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Performance Evaluation Report
USFPA Water Supply Study WS037

Report: FE005
Page: 2
Date: 06SEP96

Participant ID: IN00054

Type: OTHER

Requesting Office: IN

Sample Number	Reported Value	True Value±	Acceptance Limits	Performance Evaluation
012-LINDANE				
001	0.334	0.381	0.21-0.552	Accept.
013-METHOXYCHLOR				
001	12.6	18.5	10.2- 26.8	Accept.
014-TOXAPHENE				
002	8.23	8.81	4.85- 12.6	Accept.
097-CHLORDANE (TOTAL)				
003	3.80	4.44	2.44- 6.44	Accept.

TRIHALOMETHANES IN MICROGRAMS PER LITER:

017-CHLOROFORM				
001	22.2	22.3	17.8- 26.8	Accept.
018-BROMOFORM				
001	19.9	18.6	14.9- 22.3	Accept.
019-BROMODICHLOROMETHANE				
001	13.5	12.7	10.2- 15.2	Accept.
020-CHLORODIBROMOMETHANE				
001	15.2	14.2	11.4- 17	Accept.
021-TOTAL TRIHALOMETHANE				
001	70.8	67.8	54.2- 81.4	Accept.

VOLATILE ORGANIC COMPOUNDS IN MICROGRAMS PER LITER:

032-VINYL CHLORIDE				
001	13.9	14.8	8.88- 20.7	Accept.
034-1,1-DICHLOROETHYLENE				
001	15.4	16.5	13.2- 19.8	Accept.
035-1,2-DICHLOROETHANE				
001	15.8	13.2	10.6- 15.8	Accept.
036-1,1,1-TRICHLOROETHANE				
001	10.4	10.3	8.24- 12.4	Accept.
037-CARBON TETRACHLORIDE				
001	11.9	12.7	10.2- 15.2	Accept.
038-TRICHLOROETHYLENE				
001	8.31	6.70	5.22- 12.2	Accept.
039-BENZENE				
001	12.1	12.5	10- 15	Accept.
040-TETRACHLOROETHYLENE				
002	9.33	9.60	5.76- 13.4	Accept.
041-1,4-DICHLOROBENZENE				
001	7.55	7.31	4.39- 10.2	Accept.
042-T 1,2 DICHLOROETHYLENE				
002	13.7	14.8	11.8- 17.9	Accept.
043-C 1,2 DICHLOROETHYLENE				
002	9.61	9.72	5.83- 13.6	Accept.
044-1,2 DICHLOROPROPANE				
002	13.0	14.2	11.4- 17	Accept.

Performance Evaluation Report
USEPA Water Supply Study #S037

Report: FE005
Page: 3
Date: 06SEP96

Participant ID: IN00054

Type: OTHER

Requesting Office: IN

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
047-TOLUENE	CC2	6.44	5.70	3.42- 7.98	Accept.
048-ETHYLBENZENE	CC2	9.30	9.19	5.51- 12.9	Accept.
049-CHLOROBENZENE	CC2	8.69	8.31	4.99- 11.6	Accept.
053-STYRENE	CC2	7.55	7.40	4.44- 10.4	Accept.
054-1,2 DICHLOROBENZENE	CC2	14.4	14.5	11.6- 17.4	Accept.
055-DICHLOROMETHANE	CC1	11.3	8.41	5.05- 11.8	Accept.
061-1,1,2-TRICHLOROETHANE	CC1	11.8	10.7	8.56- 12.8	Accept.
090-TOTAL XYLENES	CC2	13.9	12.9	10.3- 15.5	Accept.

MISCELLANEOUS ANALYTES:

022-RESIDUAL FREE CHLORINE (MILLIGRAMS PER LITER)	CC1	2.71	2.20	2.03- 3.07	Accept.
024-TOTAL FILTERABLE RESIDUE (MILLIGRAMS PER LITER)	CC1	388.	264	188- 434	Accept.
025-CALCIUM HARDNESS (MG. CaCO ₃ /L)	CC1	173.	144	137- 159	Not Accept.
026-PH-UNITS	CC1	9.07	9.13	6.88- 9.31	Accept.
027-ALKALINITY (MG. CaCO ₃ /L)	CC1	31.2	27.4	25.7- 31.5	Accept.
029-SODIUM (MILLIGRAMS PER LITER)	CC1	13.4	12.6	11.4- 13.7	Accept.
145-SULFATE (MILLIGRAMS PER LITER)	CC1	278.	280	253- 316	Accept.
146-TOTAL CYANIDE (MILLIGRAMS PER LITER)	CC1	0.401	0.380	0.285-0.475	Accept.

***** END OF DATA FOR IN00054 *****

NOTE: FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.

***** END OF REPORT FOR IN00054 *****

* Based on gravimetric calculations, or a reference value when necessary.

Appendix B

The State of Wisconsin

DEPARTMENT OF NATURAL RESOURCES



Hereby grants
Certification



under the provisions of ch. NR 149, Wisconsin Administrative Code to:

American Analytical Inc (AZI)
250 West 84th Dr
Merrillville, IN 46410

998036710

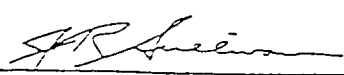
Laboratory ID Number

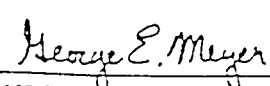
Issued: August 15, 1996

Expires: June 30, 1997

for the following test categories:

- | | |
|---------------------|----------------------------|
| * Nitrogen | Hexavalent Chromium |
| Ammonia | Mercury |
| Nitrite | Potassium |
| Kjeldahl Nitrogen | Magnesium |
| * Phosphorus | Manganese |
| Orthophosphate | Nickel |
| T. Phosphorus | Lead |
| * Physical | Antimony |
| Oil and Grease | Selenium |
| T. Dissolved Solids | Thallium |
| T. Solids | Zinc |
| T. Suspended Solids | * Organics; Purgeable |
| * General II | Volatile Organics (VOCs) |
| Chloride | * Organics; Organochlorine |
| Cyanide | PCBs |
| COO | Organochlorine Pesticides |
| Phenolics | |
| * Metals I | |
| Silver | |
| Aluminum | |
| Arsenic | |
| Barium | |
| Calcium | |
| Cadmium | |
| Chromium | |
| Copper | |
| Iron | |


Chief, Analytical and Statistical Services

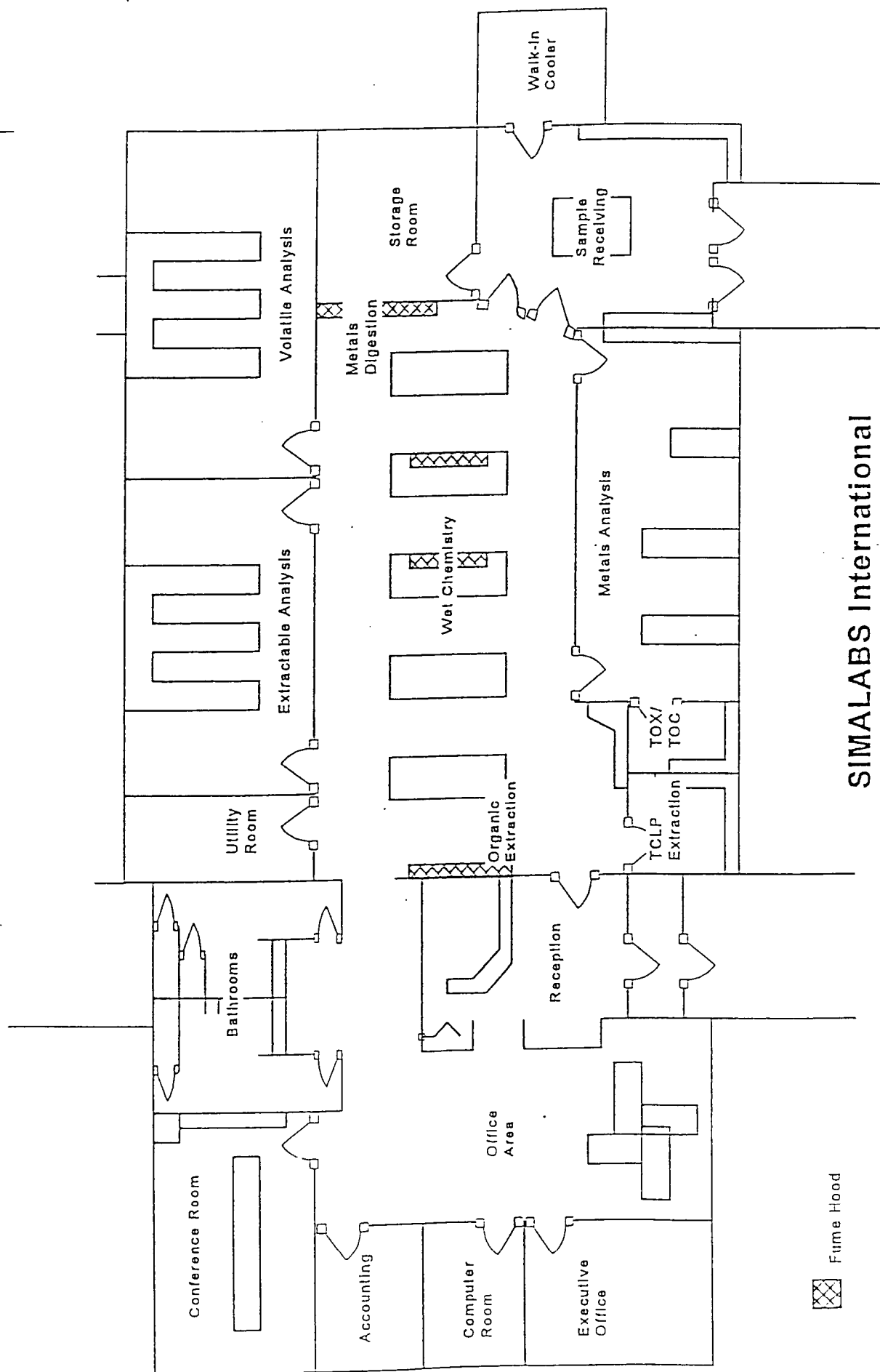

Secretary

Certification or registration by the State of Wisconsin is not an endorsement or guarantee of the validity of data generated by this laboratory. This certificate is valid unless revoked or suspended and supersedes all previous certificates.

Rev. 3-96

120'

65'



SIMALABS International

Building/Lab Diagram

250 W. 84th Drive
Merrillville, IN 46410
revised 1/22/97

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Appendix C

Chain of Custody Record

Weaver Boos Consultants, Inc.

200 South Michigan Ave.
Chicago, Illinois 60604
(312)922-1030
Fax (312)922-0201

SIMA·LABS

INTERNATIONAL

250 West 184th Drive

Merrillville, IN 46410

219-769-8378

CHAIN OF CUSTODY

Number 16172

Page _____ of _____

[illegible]

Appendix D

Field Sampling Form

Weaver Boos Consultants, Inc.

200 South Michigan Ave.
Chicago, Illinois 60604
(312)922-1030
Fax (312)922-0201

WEAVER BOOS CONSULTANTS, INC.

200 South Michigan Ave., Suite 900

Chicago, IL 60604

Groundwater Sampling Field Form

Date: _____

Site: Feddeler Construction/Demolition Site
File: 97094.00

Location: Lowell, Indiana Permit No.:45-08

Name of Person(s) Sampling: _____ Title: _____

Monitoring Well No.: _____ Upgradient: _____ Downgradient: _____

Top of Procover: _____ MSL Top of PVC: _____ MSL Ground Surface: _____ MSL

Ground Water Depth (from top of PVC): _____ ft. _____ MSL Measured Well Depth (fr. top pvc) _____ ft. _____ MSL

Installed Well Depth _____ ft. _____ MSL

Water Volume in Casing: _____ gal.

Time Purge Started: _____

Differential _____ ft. _____ MSL

2" well contains 0.163 gallons/foot

Time Purge Ended _____

Corrective Action Required Yes _____ No _____

4" well contains 0.652 gallons/foot

(Differential +/- 2 feet)

Well Diameter: _____

Total Volume Purged: _____ gal. (Min. 3 to 5 vols.) Well Pumped/Bailed Dry? Yes No

Bailer/Pump: _____ Dedicated? Yes No Disposable? Yes No

Field Meters (pH, Eh, SC): _____ Dedicated? Yes No Disposable? Yes No

Field Equipment: _____ Dedicated? Yes No Disposable? Yes No

Method of Decontamination: _____

Sample Condition: _____ Color: _____ Odor: _____

Field Measurements:	#1	#2	#3	mean	#4	new mean	#5 (if nec.)	#6 (if nec.)	std. units
pH	_____	_____	_____	_____	_____	_____	_____	_____	umhos/cm
Specific Conductivity	_____	_____	_____	_____	_____	_____	_____	_____	°C
Temperature	_____	_____	_____	_____	_____	_____	_____	_____	
Time	_____	_____	_____	_____	_____	_____	_____	_____	

Well Recharge: Very Poor Poor Fair Moderate Good Very Good

Weather Conditions: Temperature: _____ Skies: Clear Partly Cloudy Cloudy

Precipitation: _____ Light Moderate Heavy

Wind Speed/Direction: _____ N NE E SE S SW W NW

Notes/Observations: _____

Sampler(s) Signature: _____